



element

GCPAT

CWR

FCC 15.247:2020
2.4 GHz DTS Radio

Report: GCPA0001, Issue Date: June 9, 2020



NVLAP[®]
TESTING

NVLAP LAB CODE: 200881-0



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CERTIFICATE OF TEST



Last Date of Test: May 21, 2020
GCPAT
EUT: CWR

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2020	ANSI C63.10:2013, KDB 558074

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
6.5, 6.6, 11.12.1, 11.13.2,	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	N/A	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.9.1.1	Equivalent Isotropic Radiated Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Eric Brandon, Department Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY



Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS



United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

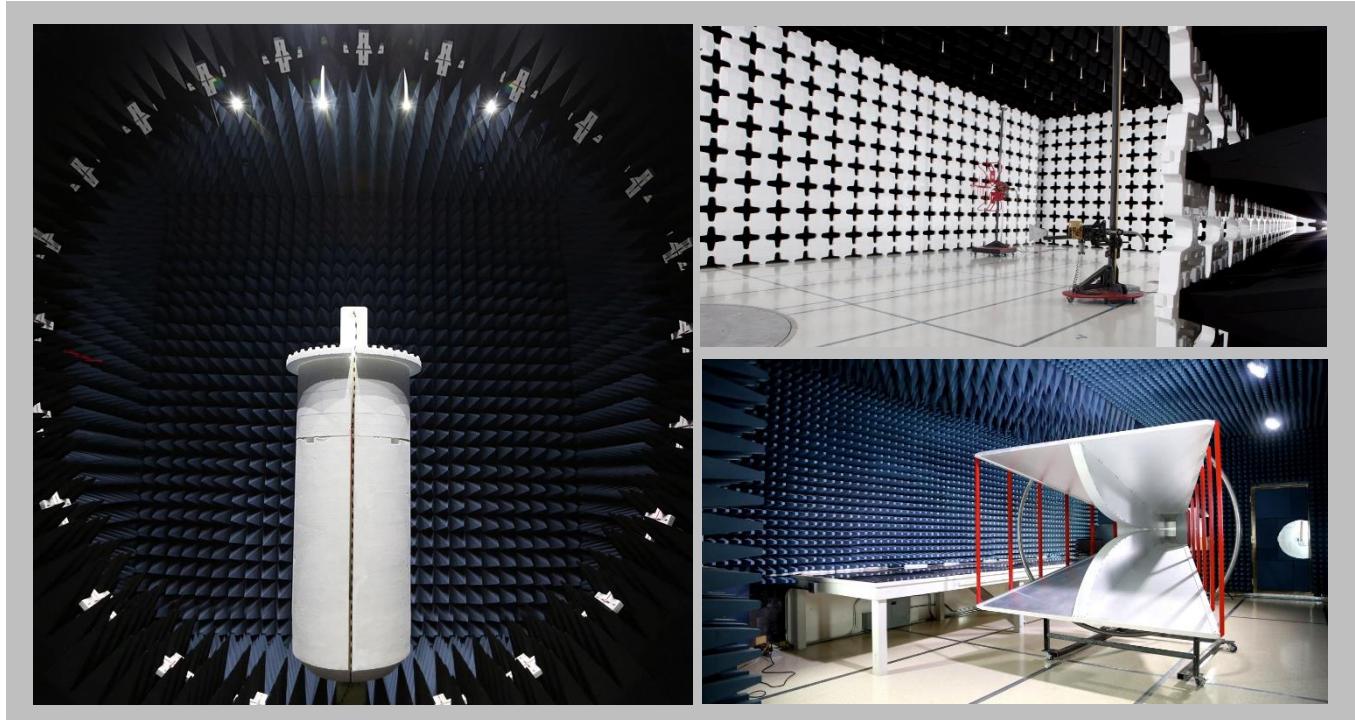
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425) 984-6600
NVLAP				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code: 201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157



MEASUREMENT UNCERTAINTY



Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

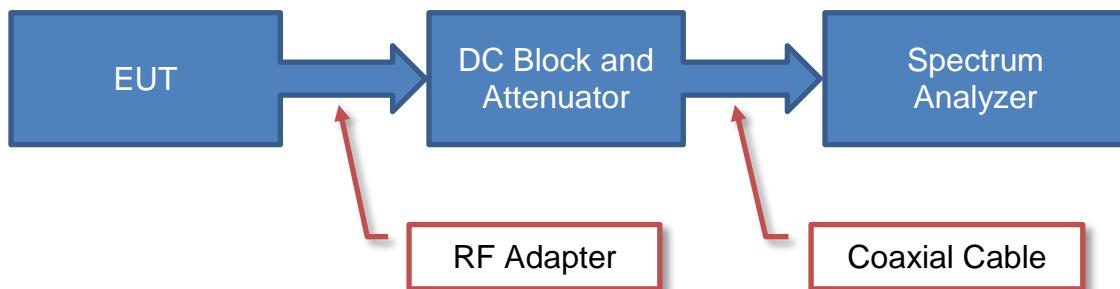
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.6 dB	-2.6 dB

Test Setup Block Diagrams

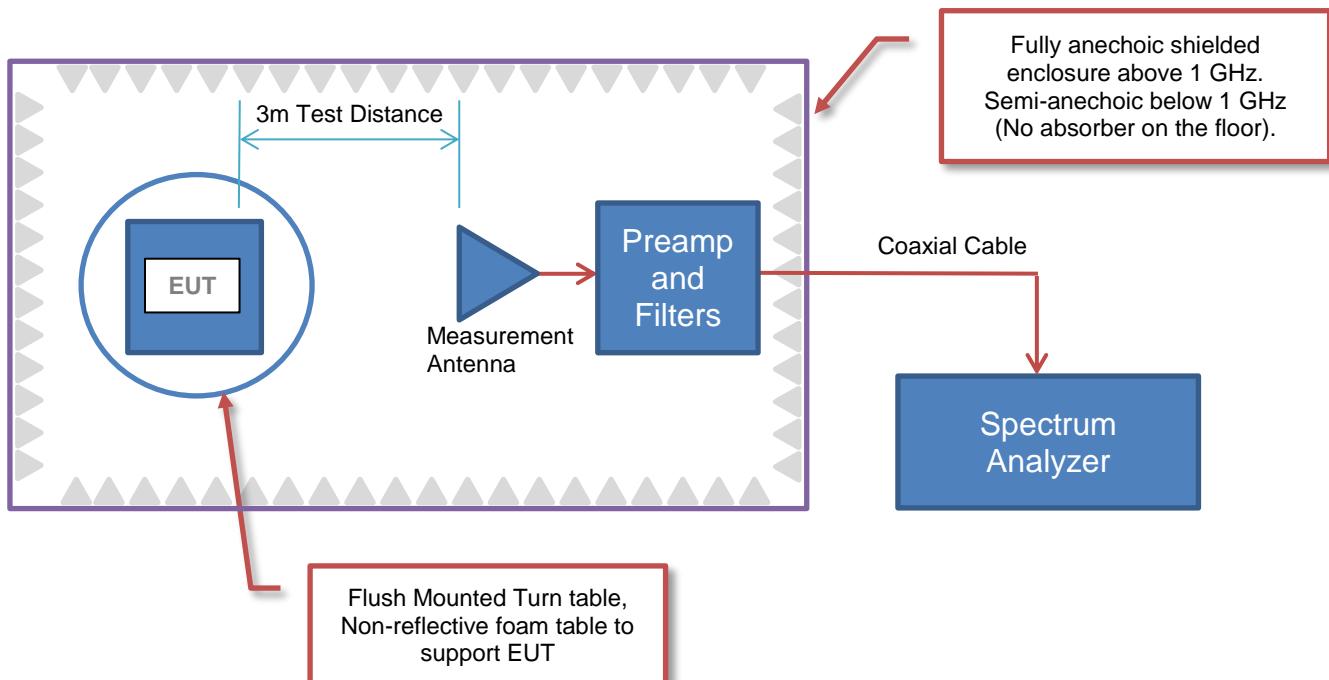
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION



Client and Equipment Under Test (EUT) Information

Company Name:	GCPAT
Address:	62 Whittemore Avenue
City, State, Zip:	Cambridge, MA 02140
Test Requested By:	Mike Castro
EUT:	CWR
First Date of Test:	May 12, 2020
Last Date of Test:	May 21, 2020
Receipt Date of Samples:	May 12, 2020
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

CAN Wireless Receiver for Vehicle. Device operates on a single channel.

Testing Objective:

To demonstrate compliance of the 2.4 GHz 6LoWPan (IPv6 over Low -Power Wireless Personal Area Networks) DTS radio to FCC 15.247 requirements.

CONFIGURATIONS



Configuration GCPA0001- 3

EUT					
Description	Manufacturer	Model/Part Number	Serial Number		
CAN Wireless Receiver	GCPAT	CWR	5019-EW6762-5793		

Peripherals in test setup boundary					
Description	Manufacturer	Model/Part Number	Serial Number		
DC Power Supply	Agilent	U8002A	TPZ		

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Cable	No	1.8 m	No	AC Mains	DC Power Cable
Power Cable	Yes	0.8 m	No	CAN Wireless Receiver	Banana Cable (x2)
Banana Cable (x2)	No	1.0 m	No	DC Power Supply	Power Cable

Configuration GCPA0001- 4

EUT					
Description	Manufacturer	Model/Part Number	Serial Number		
CAN Wireless Receiver	GCPAT	CWR	5019-EW6762-5785		

Peripherals in test setup boundary					
Description	Manufacturer	Model/Part Number	Serial Number		
DC Power Supply	Agilent	U8002A	TPZ		

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Cable	No	1.8 m	No	AC Mains	DC Power Cable
Power Cable	Yes	0.8 m	No	CAN Wireless Receiver	Banana Cable (x2)
Banana Cable (x2)	No	1.0 m	No	DC Power Supply	Power Cable

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2020-05-12	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2020-05-21	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2020-05-21	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2020-05-21	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2020-05-21	Equivalent Isotropic Radiated Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2020-05-21	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2020-05-21	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	2020-05-21	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWER SETTINGS AND ANTENNAS



The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information.

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
WLP.2450.25.4.A.02	Manufacturer	2.44GHz - 2.525GHz	5

No adjustable power settings were provided. The EUT was tested using power settings pre-defined by the manufacturer.

DUTY CYCLE - CWR



XMIT 2020.03.25.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	7-Jun-19	7-Jun-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	23-Dec-19	23-Dec-20
Generator - Signal	Agilent	N5183A	TID	26-Apr-19	26-Apr-21

TEST DESCRIPTION

The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE - CWR



XMI 2020.03.25.0

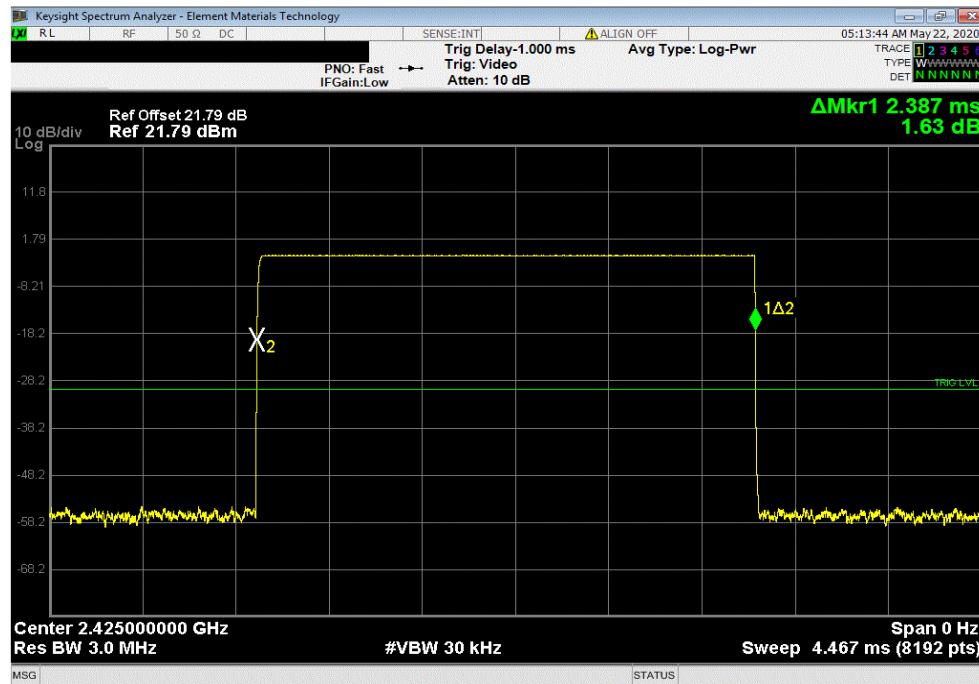
EUT:	CWR		Work Order:	GCPA0001	
Serial Number:	5019-EW6762-5785		Date:	21-May-20	
Customer:	GCPAT		Temperature:	23.2 °C	
Attendees:	None		Humidity:	49.1% RH	
Project:	None		Barometric Pres.:	1017 mbar	
Tested by:	Andrew Rogstad	Power:	12 VDC	Job Site:	MN05
TEST SPECIFICATIONS			Test Method		
FCC 15.247:2020			ANSI C63.10:2013		
COMMENTS					
Reference level offset includes measurement cable, DC block, and 20 dB attenuator.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	4	Signature			
			Pulse Width (ms)	Period (ms)	Value (%)
250 kBits/s, Single Channel, 2425 MHz, Pulse Width			2.39	N/A	N/A
250 kBits/s, Single Channel, 2425 MHz, Period			N/A	1001	0.24
250 kBits/s, Single Channel, 2425 MHz, Pulse Train			N/A	N/A	N/A

DUTY CYCLE - CWR

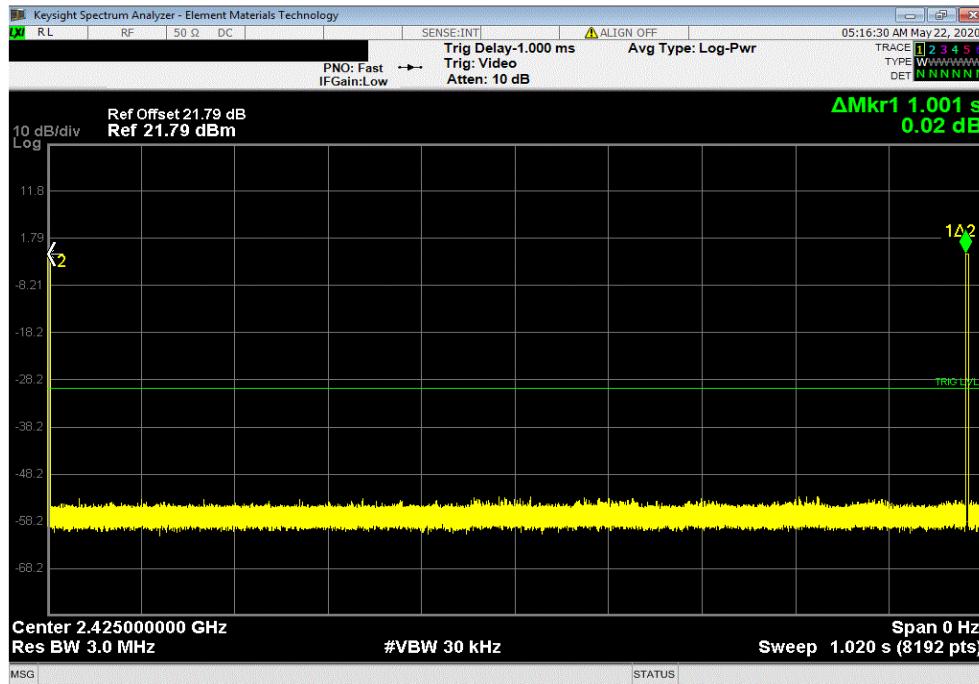


XMit 2020.03.25.0

250 kB/s, Single Channel, 2425 MHz, Pulse Width					
Pulse Width (ms)	Period (ms)	Value (%)	Limit	Result	
2.39	N/A	N/A	N/A	N/A	



250 kB/s, Single Channel, 2425 MHz, Period					
Pulse Width (ms)	Period (ms)	Value (%)	Limit	Result	
N/A	1001	0.24	N/A	N/A	



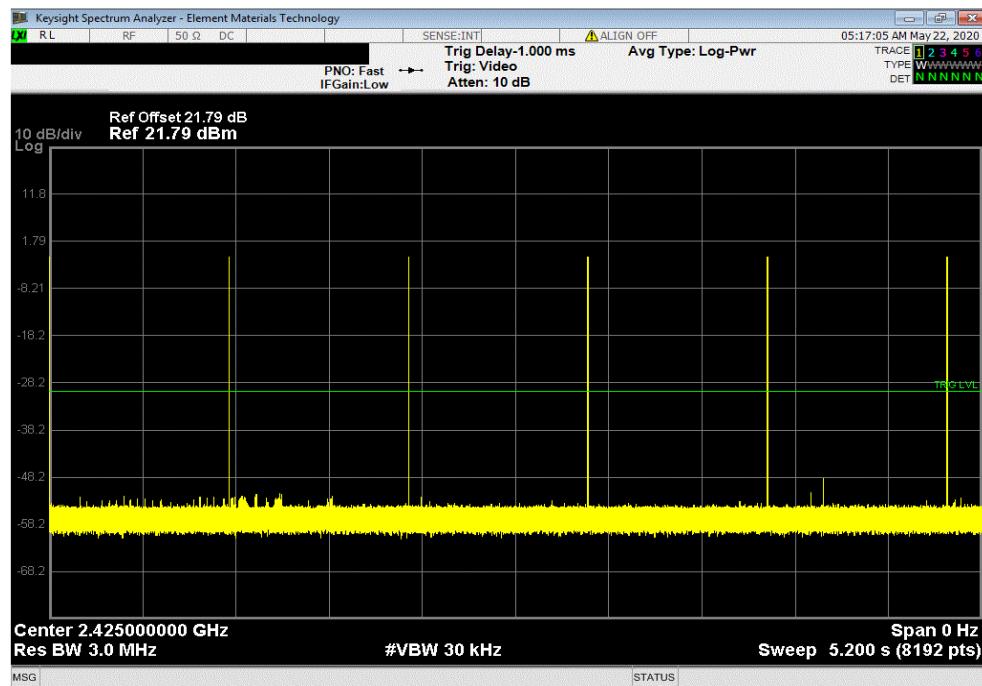
DUTY CYCLE - CWR



XMit 2020.03.25.0

250 kBits/s, Single Channel, 2425 MHz, Pulse Train

Pulse Width (ms)	Period (ms)	Value (%)	Limit	Result
N/A	N/A	N/A	N/A	N/A



SPURIOUS RADIATED EMISSIONS - CWR



PSA-ESCI 2020.04.03.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting at 2425 MHz, 250 kBits/s

POWER SETTINGS INVESTIGATED

12 VDC

CONFIGURATIONS INVESTIGATED

GCPA0001 - 3

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Filter - Low Pass	Micro-Tronics	LPM50004	LFK	2019-09-17	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	LFN	2019-09-12	12 mo
Attenuator	Fairview Microwave	SA18E-20	TWZ	2019-09-17	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2019-10-18	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2019-10-18	12 mo
Antenna - Biconilog	ETS Lindgren	3142D	AXO	2019-09-03	24 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	2019-09-11	12 mo
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNP	2019-09-11	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	2020-01-17	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	2020-01-17	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	2020-03-10	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2020-01-17	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2019-09-17	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	2019-01-16	24 mo
Power Supply - DC	Agilent	U8002A	TPZ	NCR	0 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2019-12-23	12 mo

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector

PK = Peak Detector

AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of $10 \cdot \log(1/dc)$. In the case of an EUT with a fixed duty cycle, the formula $20 \cdot \log(dc)$ is used to derive the duty cycle correction factor that is added to the peak measurement to calculate the average measurement.

SPURIOUS RADIATED EMISSIONS - CWR



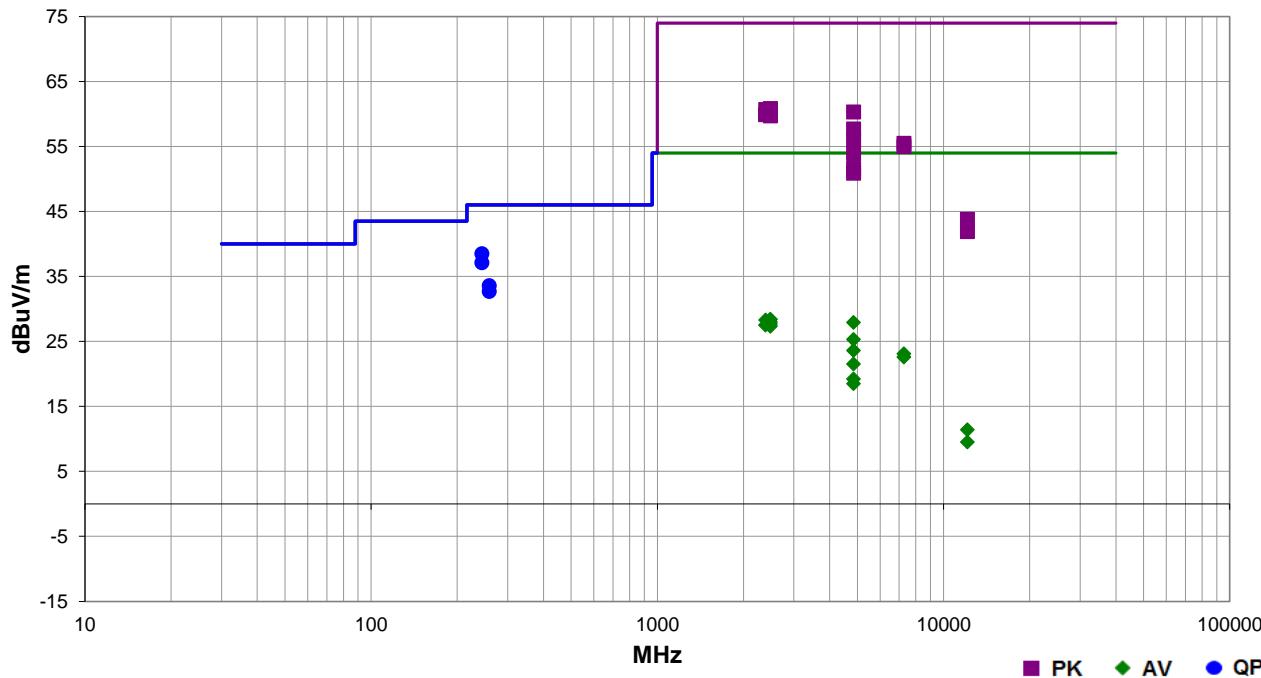
EmiR5 2020.04.20.0

PSA-ESCI 2020.04.03.0

Work Order:	GCRA0001	Date:	2020-05-21	
Project:	None	Temperature:	23.5 °C	
Job Site:	MN05	Humidity:	49.5% RH	
Serial Number:	5019-EW6762-5793	Barometric Pres.:	1020 mbar	Tested by: Andrew Rogstad
EUT:	CWR			
Configuration:	3			
Customer:	GCPAT			
Attendees:	None			
EUT Power:	12 VDC			
Operating Mode:	Transmitting at 2425 MHz, 250 kBits/s			
Deviations:	None			
Comments:	The EUT, as tested, was measured to have an on time of 2.387 ms in a 100 ms window. The customer indicated that this was the maximum on time in any 100 ms window as the EUT only transmits once every 30 seconds, so a Duty Cycle Correction Factor (DCCF) of -32.4 dB was calculated via the equation DCCF = 20*log(DC). The DCCF was added to the peak measurements to derive the average values.			

Test Specifications	Test Method
FCC 15.247:2020	ANSI C63.10:2013

Run #	15	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
243.761	41.7	-3.2	1.0	173.1	0.0	0.0	Horz	QP	0.0	38.5	46.0	-7.5	EUT horz
243.901	40.3	-3.2	1.0	198.0	0.0	0.0	Horz	QP	0.0	37.1	46.0	-8.9	EUT vert
258.484	36.4	-2.8	1.2	103.9	0.0	0.0	Horz	QP	0.0	33.6	46.0	-12.4	EUT horz
2483.720	44.6	-3.8	1.5	74.9	0.0	20.0	Horz	PK	0.0	60.8	74.0	-13.2	EUT vert
2484.923	44.6	-3.8	1.5	276.9	0.0	20.0	Horz	PK	0.0	60.8	74.0	-13.2	EUT horz
2389.777	44.4	-3.7	1.5	127.0	0.0	20.0	Horz	PK	0.0	60.7	74.0	-13.3	EUT horz
258.516	35.5	-2.8	1.5	121.9	0.0	0.0	Horz	QP	0.0	32.7	46.0	-13.3	EUT vert
2484.180	44.2	-3.8	1.5	275.0	0.0	20.0	Vert	PK	0.0	60.4	74.0	-13.6	EUT horz
4849.827	55.8	4.5	3.0	354.9	0.0	0.0	Horz	PK	0.0	60.3	74.0	-13.7	EUT vert
2484.833	44.0	-3.8	1.5	300.0	0.0	20.0	Vert	PK	0.0	60.2	74.0	-13.8	EUT vert
2484.590	43.7	-3.8	1.5	70.1	0.0	20.0	Vert	PK	0.0	59.9	74.0	-14.1	EUT on side
2389.073	43.6	-3.7	1.3	106.0	0.0	20.0	Vert	PK	0.0	59.9	74.0	-14.1	EUT horz

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2484.220	43.5	-3.8	4.0	145.0	0.0	20.0	Horz	PK	0.0	59.7	74.0	-14.3	EUT on side
4848.807	53.2	4.5	1.5	45.0	0.0	0.0	Vert	PK	0.0	57.7	74.0	-16.3	EUT horz
4850.353	51.5	4.5	2.0	270.0	0.0	0.0	Horz	PK	0.0	56.0	74.0	-18.0	EUT on side
7274.507	42.1	13.4	1.5	-0.1	0.0	0.0	Vert	PK	0.0	55.5	74.0	-18.5	EUT horz
7274.927	41.6	13.4	1.5	270.0	0.0	0.0	Horz	PK	0.0	55.0	74.0	-19.0	EUT vert
4849.000	49.4	4.5	3.0	225.0	0.0	0.0	Vert	PK	0.0	53.9	74.0	-20.1	EUT vert
4850.775	47.1	4.5	1.6	179.9	0.0	0.0	Horz	PK	0.0	51.6	74.0	-22.4	EUT horz
4849.880	46.4	4.5	1.4	135.0	0.0	0.0	Vert	PK	0.0	50.9	74.0	-23.1	EUT on side
12123.250	43.9	-0.1	1.5	90.0	0.0	0.0	Vert	PK	0.0	43.8	74.0	-30.2	EUT horz
12126.320	42.1	-0.2	1.5	359.7	0.0	0.0	Horz	PK	0.0	41.9	74.0	-32.1	EUT vert
2483.720	44.6	-3.8	1.5	74.9	-32.4	20.0	Horz	AV	0.0	28.4	54.0	-25.6	EUT vert
2484.923	44.6	-3.8	1.5	276.9	-32.4	20.0	Horz	AV	0.0	28.4	54.0	-25.6	EUT horz
2389.777	44.4	-3.7	1.5	127.0	-32.4	20.0	Horz	AV	0.0	28.3	54.0	-25.7	EUT horz
2484.180	44.2	-3.8	1.5	275.0	-32.4	20.0	Vert	AV	0.0	28.0	54.0	-26.0	EUT horz
4849.827	55.8	4.5	3.0	354.9	-32.4	0.0	Horz	AV	0.0	27.9	54.0	-26.1	EUT vert
2484.833	44.0	-3.8	1.5	300.0	-32.4	20.0	Vert	AV	0.0	27.8	54.0	-26.2	EUT vert
2484.590	43.7	-3.8	1.5	70.1	-32.4	20.0	Vert	AV	0.0	27.5	54.0	-26.5	EUT on side
2389.073	43.6	-3.7	1.3	106.0	-32.4	20.0	Vert	AV	0.0	27.5	54.0	-26.5	EUT horz
2484.220	43.5	-3.8	4.0	145.0	-32.4	20.0	Horz	AV	0.0	27.3	54.0	-26.7	EUT on side
4848.807	53.2	4.5	1.5	45.0	-32.4	0.0	Vert	AV	0.0	25.3	54.0	-28.7	EUT horz
4850.353	51.5	4.5	2.0	270.0	-32.4	0.0	Horz	AV	0.0	23.6	54.0	-30.4	EUT on side
7274.507	42.1	13.4	1.5	-0.1	-32.4	0.0	Vert	AV	0.0	23.1	54.0	-30.9	EUT horz
7274.927	41.6	13.4	1.5	270.0	-32.4	0.0	Horz	AV	0.0	22.6	54.0	-31.4	EUT vert
4849.000	49.4	4.5	3.0	225.0	-32.4	0.0	Vert	AV	0.0	21.5	54.0	-32.5	EUT vert
4850.775	47.1	4.5	1.6	179.9	-32.4	0.0	Horz	AV	0.0	19.2	54.0	-34.8	EUT horz
4849.880	46.4	4.5	1.4	135.0	-32.4	0.0	Vert	AV	0.0	18.5	54.0	-35.5	EUT on side
12123.250	43.9	-0.1	1.5	90.0	-32.4	0.0	Vert	AV	0.0	11.4	54.0	-42.6	EUT horz
12126.320	42.1	-0.2	1.5	359.7	-32.4	0.0	Horz	AV	0.0	9.5	54.0	-44.5	EUT vert

OCCUPIED BANDWIDTH - CWR



element

XMit 2020.03.25.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	7-Jun-19	7-Jun-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	23-Dec-19	23-Dec-20
Generator - Signal	Agilent	N5183A	TID	26-Apr-19	26-Apr-21

TEST DESCRIPTION

The EUT was set to the channels and modes listed in the datasheet.

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.

OCCUPIED BANDWIDTH - CWR



TbITx 2019.08.30.0

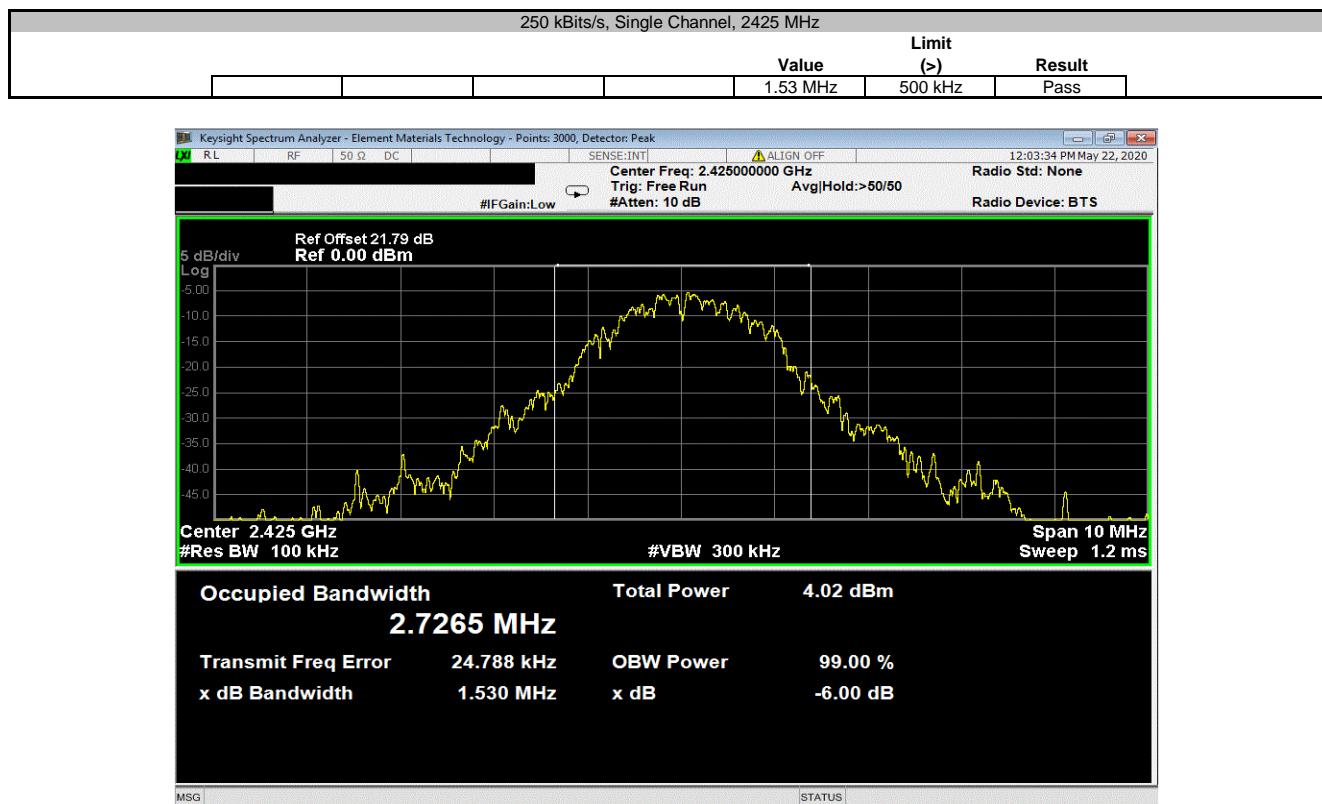
XMit 2020.03.25.0

EUT:	CWR		Work Order:	GCPA0001	
Serial Number:	5019-EW6762-5785		Date:	21-May-20	
Customer:	GCPAT		Temperature:	23.1 °C	
Attendees:	None		Humidity:	50.3% RH	
Project:	None		Barometric Pres.:	1017 mbar	
Tested by:	Andrew Rogstad	Power:	12 VDC	Job Site:	MN05
TEST SPECIFICATIONS					
FCC 15.247:2020		Test Method ANSI C63.10:2013			
COMMENTS					
Reference level offset includes measurement cable, DC block, and 20 dB attenuator.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	4	Signature			
				Limit (>)	Result
250 kBit/s, Single Channel, 2425 MHz				1.52 MHz	Pass

OCCUPIED BANDWIDTH - CWR



TbtTx 2019.08.30.0 XMit 2020.03.25.0



OUTPUT POWER - CWR



XMit 2020.03.25.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	7-Jun-19	7-Jun-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	23-Dec-19	23-Dec-20
Generator - Signal	Agilent	N5183A	TID	26-Apr-19	26-Apr-21

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

OUTPUT POWER - CWR



TbTx 2019.08.30.0 XMII 2020.03.25.0

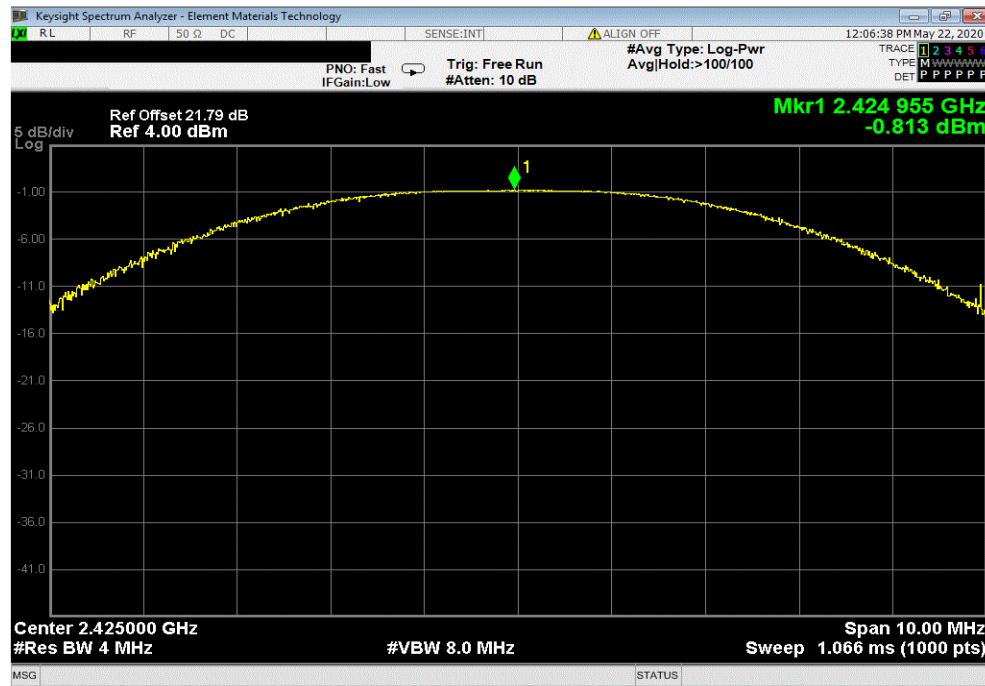
EUT:	CWR		Work Order:	GCPA0001	
Serial Number:	5019-EW6762-5785		Date:	21-May-20	
Customer:	GCPAT		Temperature:	23.2 °C	
Attendees:	None		Humidity:	50.3% RH	
Project:	None		Barometric Pres.:	1017 mbar	
Tested by:	Andrew Rogstad	Power:	12 VDC	Job Site:	MN05
TEST SPECIFICATIONS			Test Method		
FCC 15.247:2020			ANSI C63.10:2013		
COMMENTS					
Reference level offset includes measurement cable, DC block, and 20 dB attenuator.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	4	Signature	<i>Andrew Rogstad</i>	Out Pwr (dBm)	Limit (dBm)
				-0.813	30
				Pass	
250 kBits/s, Single Channel, 2425 MHz					

OUTPUT POWER - CWR



TbtTx 2019.08.30.0 XMit 2020.03.25.0

250 kBits/s, Single Channel, 2425 MHz				Out Pwr (dBm)	Limit (dBm)	Result
				-0.813	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) - CWR



XMit 2020.03.25.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	7-Jun-19	7-Jun-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	23-Dec-19	23-Dec-20
Generator - Signal	Agilent	N5183A	TID	26-Apr-19	26-Apr-21

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

Equivalent Isotropic Radiated Power (EIRP) = Max Measured Power + Antenna gain (dBi)

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) - CWR



TbTx 2019.08.30.0 XMII 2020.03.25.0

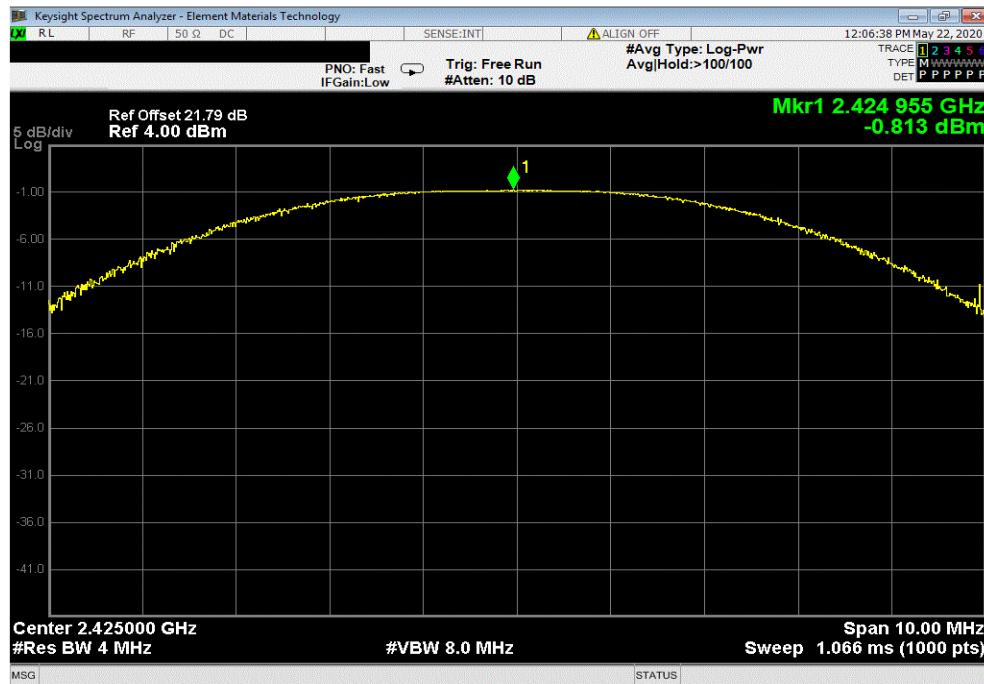
EUT:	CWR		Work Order:	GCPA0001	
Serial Number:	5019-EW6762-5785		Date:	21-May-20	
Customer:	GCPAT		Temperature:	23.1 °C	
Attendees:	None		Humidity:	50.4% RH	
Project:	None		Barometric Pres.:	1017 mbar	
Tested by:	Andrew Rogstad	Power:	12 VDC	Job Site:	MN05
TEST SPECIFICATIONS			Test Method		
FCC 15.247:2020			ANSI C63.10:2013		
COMMENTS					
Reference level offset includes measurement cable, DC block, and 20 dB attenuator.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	4	Signature		Out Pwr (dBm)	Antenna Gain (dBi)
			-0.813	5	EIRP (dBm)
				4.187	EIRP Limit (dBm)
				36	Result
250 kBits/s, Single Channel, 2425 MHz					Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) - CWR



TbtTx 2019.08.30.0 XMit 2020.03.25.0

250 kBits/s, Single Channel, 2425 MHz					
Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
-0.813	5	4.187	36	Pass	



POWER SPECTRAL DENSITY - CWR



XMit 2020.03.25.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	7-Jun-19	7-Jun-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	23-Dec-19	23-Dec-20
Generator - Signal	Agilent	N5183A	TID	26-Apr-19	26-Apr-21

TEST DESCRIPTION

The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY - CWR



TbTx 2019.08.30.0 XMII 2020.03.25.0

EUT:	CWR		Work Order:	GCPA0001	
Serial Number:	5019-EW6762-5785		Date:	21-May-20	
Customer:	GCPAT		Temperature:	23.2 °C	
Attendees:	None		Humidity:	50.2% RH	
Project:	None		Barometric Pres.:	1017 mbar	
Tested by:	Andrew Rogstad	Power:	12 VDC	Job Site:	MN05
TEST SPECIFICATIONS			Test Method		
FCC 15.247:2020			ANSI C63.10:2013		
COMMENTS					
Reference level offset includes measurement cable, DC block, and 20 dB attenuator.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	4	Signature			
			Value dBm/3kHz	Limit < dBm/3kHz	Result
			-14.617	8	Pass

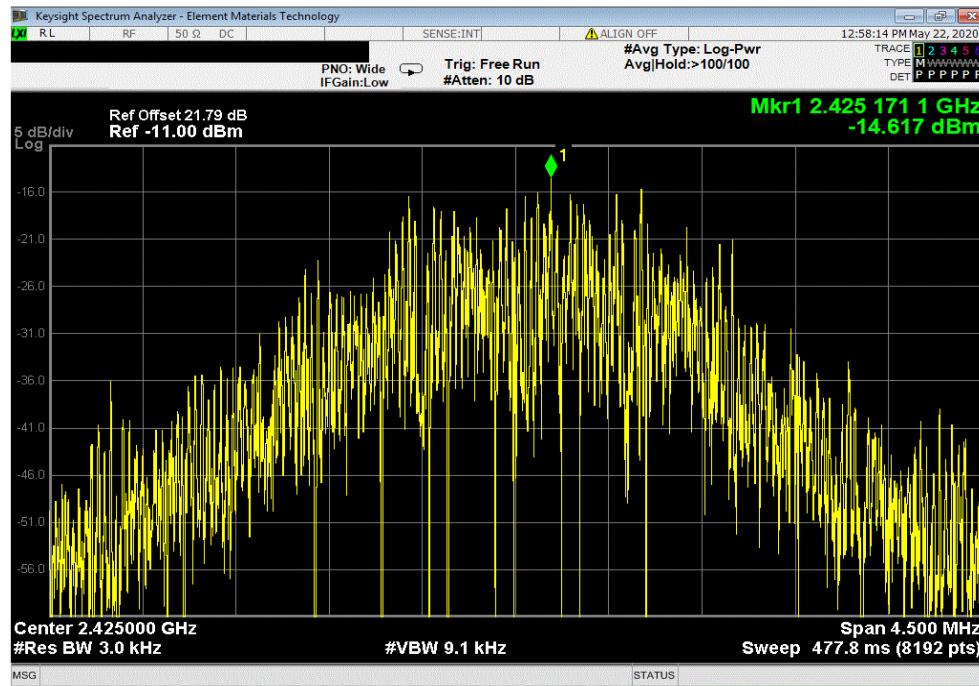
250 kBits/s, Single Channel, 2425 MHz

POWER SPECTRAL DENSITY - CWR



TbtTx 2019.08.30.0 XMit 2020.03.25.0

250 kBits/s, Single Channel, 2425 MHz				Value	Limit	Result
				dBm/3kHz	< dBm/3kHz	
				-14.617	8	Pass



BAND EDGE COMPLIANCE - CWR



element

XMit 2020.03.25.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	7-Jun-19	7-Jun-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	23-Dec-19	23-Dec-20
Generator - Signal	Agilent	N5183A	TID	26-Apr-19	26-Apr-21

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE - CWR



TbTx 2019.08.30.0 XMII 2020.03.25.0

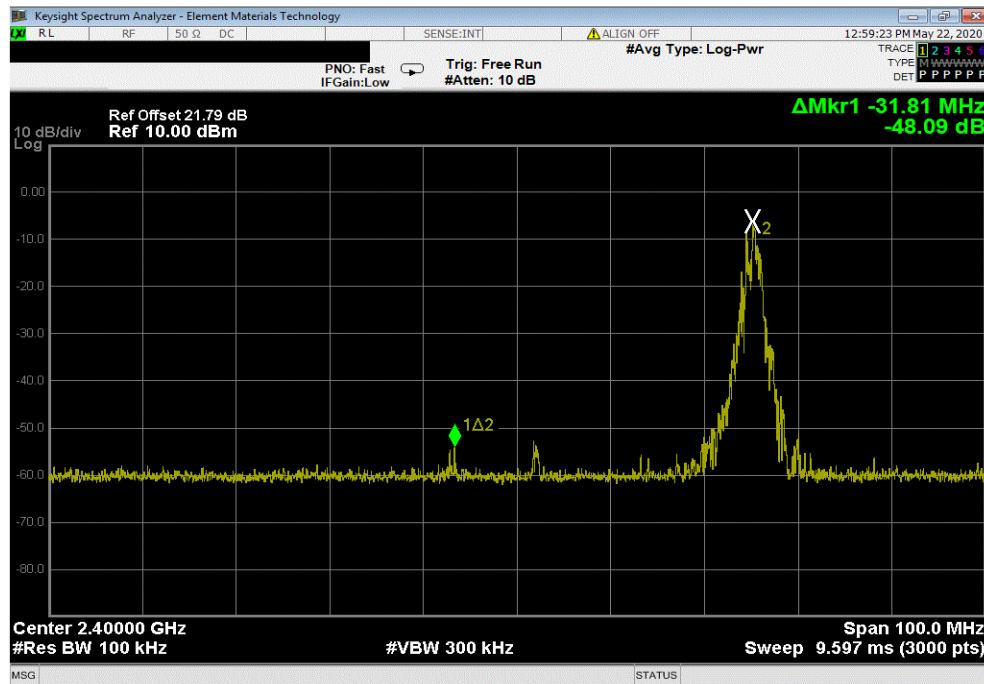
EUT:	CWR		Work Order:	GCPA0001	
Serial Number:	5019-EW6762-5785		Date:	21-May-20	
Customer:	GCPAT		Temperature:	22.9 °C	
Attendees:	None		Humidity:	50.7% RH	
Project:	None		Barometric Pres.:	1017 mbar	
Tested by:	Andrew Rogstad	Power:	12 VDC	Job Site:	MN05
TEST SPECIFICATIONS			Test Method		
FCC 15.247:2020			ANSI C63.10:2013		
COMMENTS					
Reference level offset includes measurement cable, DC block, and 20 dB attenuator.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	4	Signature			
			Value (dBc)	Limit ≤ (dBc)	Result
			-48.09	-20	Pass
			-44.5	-20	Pass
250 kBits/s, Single Channel, 2425 MHz, Low Band Edge					
250 kBits/s, Single Channel, 2425 MHz, High Band Edge					

BAND EDGE COMPLIANCE - CWR

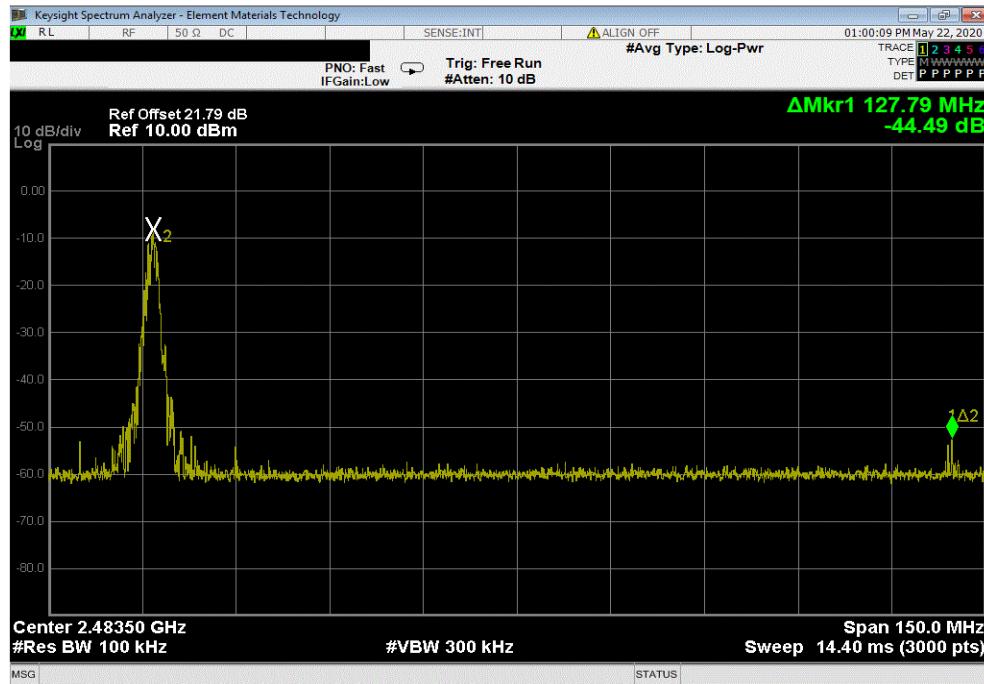


TbITx 2019.08.30.0 XMit 2020.03.25.0

250 kBits/s, Single Channel, 2425 MHz, Low Band Edge			
	Value (dBc)	Limit ≤ (dBc)	Result
	-48.09	-20	Pass



250 kBits/s, Single Channel, 2425 MHz, High Band Edge			
	Value (dBc)	Limit ≤ (dBc)	Result
	-44.5	-20	Pass



SPURIOUS CONDUCTED EMISSIONS - CWR



XMit 2020.03.25.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	7-Jun-19	7-Jun-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	23-Dec-19	23-Dec-20
Generator - Signal	Agilent	N5183A	TID	26-Apr-19	26-Apr-21

TEST DESCRIPTION

The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS - CWR



TbTx 2019.08.30.0 XMII 2020.03.25.0

EUT:	CWR		Work Order:	GCPA0001	
Serial Number:	5019-EW6762-5785		Date:	21-May-20	
Customer:	GCPAT		Temperature:	23.2 °C	
Attendees:	None		Humidity:	49.1% RH	
Project:	None		Barometric Pres.:	1017 mbar	
Tested by:	Andrew Rogstad	Power:	12 VDC	Job Site:	MN05
TEST SPECIFICATIONS			Test Method		
FCC 15.247:2020			ANSI C63.10:2013		
COMMENTS					
Reference level offset includes measurement cable, DC block, and 20 dB attenuator.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	4	Signature			
		Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)
250 kBits/s, Single Channel, 2425 MHz		Fundamental	2425.15	N/A	N/A
250 kBits/s, Single Channel, 2425 MHz		30 MHz - 12.5 GHz	2168.98	-32.98	-20
250 kBits/s, Single Channel, 2425 MHz		12.5 GHz - 25 GHz	24030.95	-43.96	-20
					Pass
					Pass

SPURIOUS CONDUCTED EMISSIONS - CWR

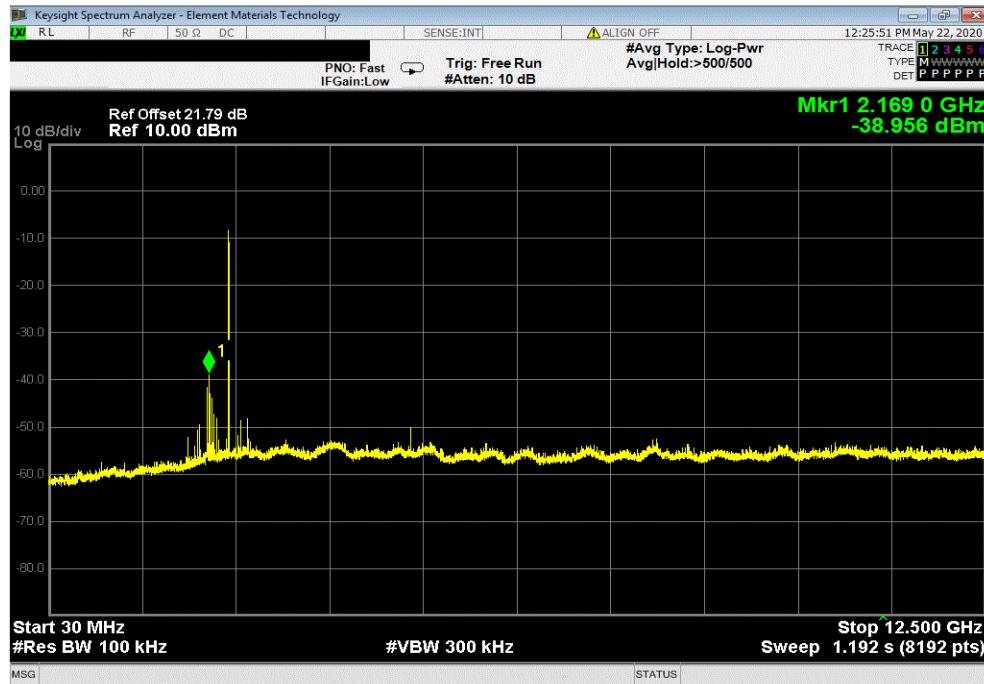


TbtTx 2019.08.30.0 XMit 2020.03.25.0

250 kBits/s, Single Channel, 2425 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit \leq (dBc)	Result	
Fundamental	2425.15	N/A	N/A	N/A	



250 kBits/s, Single Channel, 2425 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit \leq (dBc)	Result	
30 MHz - 12.5 GHz	2168.98	-32.98	-20	Pass	



SPURIOUS CONDUCTED EMISSIONS - CWR



TbtTx 2019.08.30.0 XMit 2020.03.25.0

250 kBits/s, Single Channel, 2425 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz	24030.95	-43.96	-20	Pass

