

FCC - TEST REPORT

Report Number	:	60.790.21.075.01R01	Date of Issue	: December 29, 2021
Model	:	QTM-UAR10, QTM-UMF	R10, QTM-SMR10	
Product Type	:	Quantum RTLS Universal Quantum RTLS Universal Quantum RTLS Universal	Mobile (for QTM-UM	R10)
Applicant	:	ZEROKEY INC.		
Address	:	3120 12TH ST NE, CAL	GARY ALBERTA, C	ANADA T2E 8T3
Production Facility	:	AUGUST ELECTRONIC	INC.	
Address	:	1810 CENTRE AVE NE	CALGARY ALBERT	A CANADA T2E 0A6
Test Result	:	nPositive	○Negative	
Total pages including Appendices	:	62		

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2 Description of Equipment Under Test

Description of the Equipment Under Test

Product:	Quantum RTLS Universal Anchor (for QTM-UAR10) Quantum RTLS Universal Mobile (for QTM-UMR10) Quantum RTLS Universal Tag (for QTM-SMR10)
Model no.:	QTM-UAR10, QTM-UMR10, QTM-SMR10
FCC ID:	2AX6LQTMUR10
Rating:	3.7V DC (Form internal rechargeable battery) 5.0V DC (Form USB port, for charging)
Frequency:	Enhanced Shockburst: 2402MHz-2480MHz
Antenna gain:	5.46dBi
Mode:	1Mbps data rate mode, 2Mbps data rate mode
Number of operated channels:	40
Modulation:	GFSK
Remark:	

Auxiliary Equipment and Software Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Computer	Lenovo	X220	0A72168
AC/DC adapter	Apple	A1537	/

Auxiliary Software Used during Test:

DESCRIPTION	SOFTWARE NAME	VERSION	REMARK
RF Test Mode	nRF connect	3.7.1	Provided by applicant
Software			



3 Summary of Test Standards

Test Standards

FCC Part 15 Subpart C 10-1-20 Edition Federal Communications Commission, PART 15 — Radio Frequency Devices, Subpart C —Intentional Radiators

All the test methods were according to KDB558074 D01 v05r02 DTS Measurement Guidance and ANSI C63.10 (2013).



4 Details about the Test Laboratory

Site 1

Company name:

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12&13 Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Shenzhen 518052, P.R.China FCC Registration Number: 514049 ISED test site number: 10320A

Emission Tests			
Test Item	Test Site		
FCC Part 15 Subpart C			
FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission	Site 1		
FCC Title 47 Part 15.207 Conduct Emission	Site 1		
FCC Title 47 Part 15.247(a)(1) 6dB & 99% Bandwidth	Site 1		
FCC Title 47 Part 15.247(b) Peak Output Power	Site 1		
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	Site 1		
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	Site 1		
FCC Title 47 Part 15.247(e) Power Spectral Density	Site 1		
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	Site 1		



4.1 Test Equipment Site List

Radiated emission Test - Site 1

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2022-6-29
Signal Analyzer	Rohde & Schwarz	FSV40	101031	2022-6-22
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100398	2022-7-7
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2022-8-4
Horn Antenna	Rohde & Schwarz	HF907	102294	2022-7-5
Wideband Horn Antenna	Q-PAR	QWH-SL-18- 40-K-SG	12827	2022-6-21
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2022-6-21
Pre-amplifier	Rohde & Schwarz	SCU 40A	100432	2022-7-30
Attenuator	Agilent	8491A	MY39264334	2022-6-21
3m Semi-anechoic chamber	TDK	9X6X6		2022-10-28
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

Conducted Emission Test – Site 1

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2022-6-29
LISN	Rohde & Schwarz	ENV4200	100249	2022-6-12
LISN	Rohde & Schwarz	ENV432	101318	2022-6-12
LISN	Rohde & Schwarz	ENV216	100326	2022-6-12
LISN	Rohde & Schwarz	ENV216	102472	2022-6-12
ISN	Rohde & Schwarz	ENY81	100177	2022-6-12
ISN	Rohde & Schwarz	ENY81-CA6	101664	2022-6-12
High Voltage Probe	Schwarzbeck	TK9420(VT9420)	9420-584	2022-6-23
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2022-6-28
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2022-6-21
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A
Shielding Room	TDK	CSR #1		2022-11-07

20dB & 99% Bandwidth, Peak Output Power, Spurious Emissions at Antenna Terminals, 100kHz Bandwidth of band edges, Power Spectral Density – Site 1

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2022-6-21
RF Switch Module	Rohde & Schwarz	OSP120/OSP- B157	101226/100851	2022-6-21



4.2 Measurement System Uncertainty

Measurement System Uncertainty Emissions

System Measurement Uncertainty				
Items	Extended Uncertainty			
Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz	4.66dB			
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.68dB; Vertical: 4.65dB;			
Uncertainty for Radiated Emission in 3m chamber 1000MHz-25000MHz	Horizontal: 4.76dB; Vertical: 4.75dB;			
Uncertainty for Conducted Emission at AC Power Line 150kHz-30MHz	2.72 dB			
Uncertainty for conducted power test	1.27dB			
Uncertainty for frequency test	0.6×10 ⁻⁷			

Measurement System Uncertainty Immunity

The measurement expanded uncertainties for defined systems are for a 95% confidence level, in accordance with the recommendations of ISO 17025.

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.



5 Summary of Test Results

Emission Tests					
FCC Part 15 Subpart C					
Test Condition	Pages	Те	st Resu	st Result	
		Pass	Fail	N/A	
FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission	12-15				
FCC Title 47 Part 15.207 Conduct Emission	16-17	\boxtimes			
FCC Title 47 Part 15.247(a)(2) 6dB & 99% Bandwidth	18-23	\square			
FCC Title 47 Part 15.247(b) Peak Output Power	24-29	\square			
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	30-41	\square			
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	42-45	\square			
FCC Title 47 Part 15.247(e) Power Spectral Density	46-51	\square			
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	52	\square			



6 General Remarks

Remarks

All mode & voltage has been tested, only worst case has shown.

Client informs that QTM-UAR10 and, QTM-UAR10 are in the same enclosure, use the same board and the QTM-UAR10 model has the MEMS IMU sensors populated. QTM-SMR10 uses a different enclosure and has a vibrator motor and piezo beeper installed. All other components are the same, and their PCB boards are completely same. (Client's conformation letter shown at Appendix B). All tests were performed on main model QTM-UAR10.

This submittal(s) (test report) is intended for FCC ID: 2AX6LQTMUR10, complies with Section 15.203, 15.205, 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules for the DTS grant.

The TX and RX range is 2402MHz-2480MHz.

SUMMARY:

- All tests according to the regulations cited on page 8 were

n - Performed

O - Not Performed

- The Equipment Under Test

n - Fulfills the general approval requirements.

• - **Does not** fulfill the general approval requirements.

Sample Received Date: June 21, 2021

July 9, 2021 Testing Start Date:

Testing End Date:

July 27, 2021

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:

Prepared by:

Tested by:

Eric LI EMC Project Manager

SUD

ninse Lin

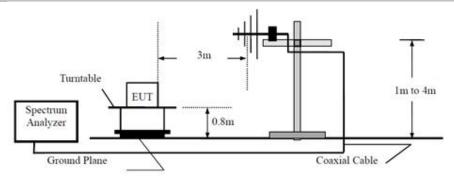
Hosea CHAN EMC Project Engineer

Louise Liu EMC Test Engineer

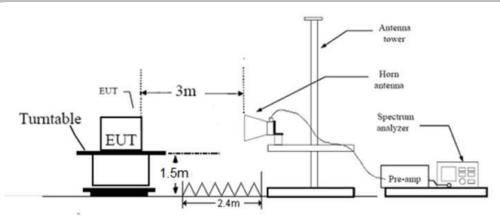


7 Test Setups

7.1 Radiated test setups Below 1GHz

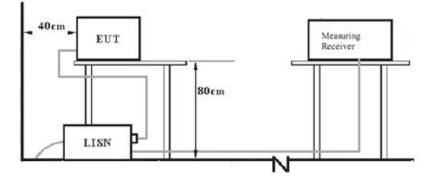


7.2 Radiated test setups Above 1GHz

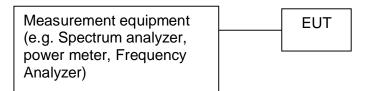




7.3 AC Power Line Conducted Emission test setups



7.4 Conducted RF test setups





8 Emission Test Results

8.1 Spurious Radiated Emission

EU	T:	
Op	Condition:	

Comment:

Remark:

Test Specification:

QTM-UAR10 Operated, TX Mode, 2Mbps Mode (Middle channel is the worst case) FCC15.205, 15.209 & 15.247(d) 3.7V DC Below 1GHz Test Result ⊠ Passed

Not Passed

Frequency	Result	Limit	Margin	Detector	Ant. Polarity	Corr.
MHz	dBµV/m	dBµV/m	dB	PK/QP/AV	H/V	(dB)
48.430000	18.62	40.00	21.38	Peak	Н	15.22
99.415625	16.64	43.50	26.86	Peak	Н	13.07
202.781250	18.13	43.50	25.37	Peak	Н	13.31
309.420625	21.31	46.00	24.69	Peak	Н	15.86
442.128750	25.05	46.00	20.95	Peak	Н	19.17
702.452500	29.78	46.00	16.22	Peak	Н	23.86
35.880625	20.76	40.00	19.24	Peak	V	12.73
56.371875	19.57	40.00	20.43	Peak	V	14.74
76.863125	23.50	40.00	16.50	Peak	V	9.22
199.871250	20.61	43.50	22.89	Peak	V	13.32
392.052500	22.72	46.00	23.28	Peak	V	18.17
948.590000	35.03	46.00	10.97	Peak	V	27.36

Remark:

1. As the measured peak value not exceeded the Quasi-peak limit, Quasi-peak value no need to be measured.

 Result Level=Reading Level + Correction Factor
 Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
 Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
 (The Reading Level is recorded by software which is not shown in the sheet)

3. No obvious difference between 1Mbps mode data and 2Mbps mode data, therefore we shown here 2Mbps mode data.



Δnt

Spurious Radiated Emission

EUT:	QTM-UAR10	Test Result
Op Condition:	Operated, TX Mode (2402MHz), 2Mbps Mode	☐ Passed
Test Specification:	FCC15.205, 15.209 & 15.247(d)	☐ Not Passed
Comment: Remark:	3.7V DC 1GHz to 25GHz	

Frequency	Result	Limit	Margin	Detector	Polarity	Corr.
MHz	dBµV/m	dBµV/m	dB	PK/QP/AV	H/V	(dB)
2330.000000	45.12	74.00	28.88	Peak	Н	-2.09
3268.000000	45.71	74.00	28.29	Peak	Н	0.38
4272.500000	48.48	74.00	25.52	Peak	Н	3.22
7903.500000	42.26	74.00	31.74	Peak	Н	7.88
9867.000000	44.29	74.00	29.71	Peak	Н	11.35
12012.000000	46.21	74.00	27.79	Peak	Н	10.30
1824.000000	45.45	74.00	28.55	Peak	V	-4.69
2976.500000	44.84	74.00	29.16	Peak	V	-0.11
4520.000000	46.73	74.00	27.27	Peak	V	3.38
7205.500000	45.12	74.00	28.88	Peak	V	6.80
10409.500000	44.75	74.00	29.25	Peak	V	10.44
14598.000000	45.40	74.00	28.60	Peak	V	13.08

Remark:

- 1. According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in data table if the peak value complies with average limit.
- Consequence Level=Reading Level + Correction Factor Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain Below 1GHz: Corrector factor = Antenna Factor + Cable Loss (The Reading Level is recorded by software which is not shown in the sheet)
- 3. No obvious difference between 1Mbps mode data and 2Mbps mode data, therefore we shown here 2Mbps mode data.



Spurious Radiated Emission

EUT: Op Condition: Test Specification: Comment: Remark:	-	X Mode (2440N 15.209 & 15.2	Test Resu	d		
Frequency	Result	Limit	Margin	Detector	Ant. Polarity	Corr.
MHz	dBµV/m	dBµV/m	dB	PK/QP/AV	H/V	(dB)
1428.000000	40.89	74.00	33.11	Peak	Н	-8.03
2376.500000	44.99	74.00	29.01	Peak	Н	-2.11
4294.000000	47.76	74.00	26.24	Peak	Н	3.18
7319.000000	41.69	74.00	32.31	Peak	Н	7.04
12199.000000	49.30	74.00	24.70	Peak	Н	10.20
15964.000000	48.63	74.00	25.37	Peak	Н	16.08
3534.500000	46.66	74.00	27.34	Peak	V	0.55
4420.000000	48.41	74.00	25.59	Peak	V	3.26
5225.500000	49.09	74.00	24.91	Peak	V	4.91
7319.000000	43.87	74.00	30.13	Peak	V	7.04
12201.500000	45.38	74.00	28.62	Peak	V	10.21
15916.000000	49.09	74.00	24.91	Peak	V	15.83

Remark:

- 1. According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in data table if the peak value complies with average limit.
- Consequence Level=Reading Level + Correction Factor Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain Below 1GHz: Corrector factor = Antenna Factor + Cable Loss (The Reading Level is recorded by software which is not shown in the sheet)
- 3. No obvious difference between 1Mbps mode data and 2Mbps mode data, therefore we shown here 2Mbps mode data



Δnt

Spurious Radiated Emission

EUT:	QTM-UAR10	Test Result
Op Condition:	Operated, TX Mode (2480MHz), 2Mbps Mode	☐ Passed
Test Specification:	FCC15.205, 15.209 & 15.247(d)	☐ Not Passed
Comment: Remark:	3.7V DC 1GHz to 25GHz	

Frequency	Result	Limit	Margin	Detector	Polarity	Corr.
MHz	dBµV/m	dBµV/m	dB	PK/QP/AV	H/V	(dB)
2257.000000	43.97	74.00	30.03	Peak	Н	-2.54
3078.500000	45.88	74.00	28.12	Peak	Н	0.17
5278.500000	48.94	74.00	25.06	Peak	Н	4.93
9892.000000	45.22	74.00	28.78	Peak	Н	10.88
12402.000000	52.02	74.00	21.98	Peak	Н	10.43
12402.000000	51.35	54.00	2.65	Average	Н	10.43
15948.000000	48.58	74.00	25.42	Peak	Н	16.00
1994.500000	46.10	74.00	27.90	Peak	V	-3.25
2620.500000	44.25	74.00	29.75	Peak	V	-1.32
3638.000000	46.94	74.00	27.06	Peak	V	0.68
7439.500000	46.45	74.00	27.55	Peak	V	7.22
9855.500000	43.87	74.00	30.13	Peak	V	11.37
12958.000000	44.30	74.00	29.70	Peak	V	11.31

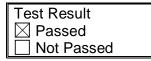
Remark:

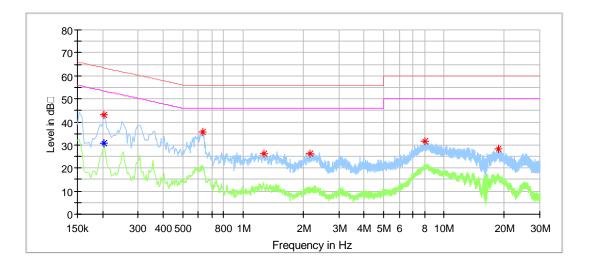
- 1. According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in data table if the peak value complies with average limit.
- Consequence Level=Reading Level + Correction Factor Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain Below 1GHz: Corrector factor = Antenna Factor + Cable Loss (The Reading Level is recorded by software which is not shown in the sheet)
- 3. No obvious difference between 1Mbps mode data and 2Mbps mode data, therefore we shown here 2Mbps mode data



8.2 Conducted Emission at AC Power line

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Charging mode FCC15.207, AC Mains, L Line 120V AC, 60Hz (supporting adapter input)





Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Corr. (dB)
0.202000	42.99		63.53	20.54	9.64
0.202000		30.90	53.53	22.63	9.64
0.630000	35.52		56.00	20.48	9.65
1.266000	26.37		56.00	29.63	9.66
2.146000	26.16		56.00	29.84	9.69
8.030000	31.55		60.00	28.45	9.85
18.586000	28.30		60.00	31.70	9.98



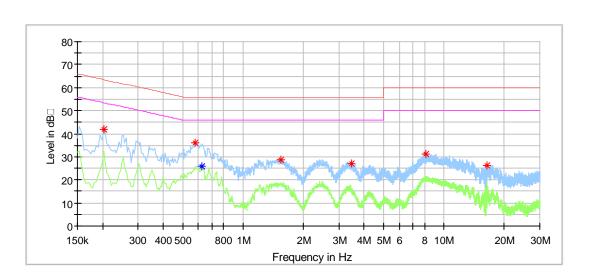
Test Result

 \boxtimes Passed

Not Passed

Conducted Emission Test

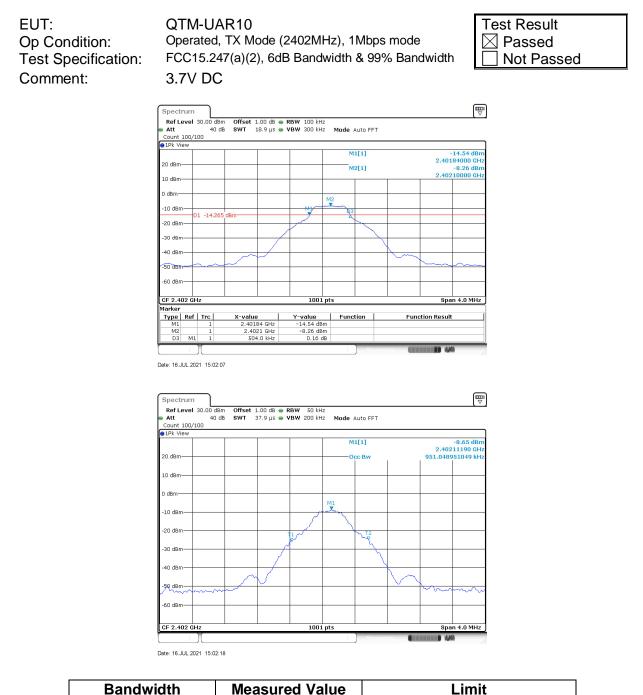
EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Charging mode FCC15.207, AC Mains, N Line 120V AC, 60Hz (supporting adapter input)



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Corr. (dB)
0.202000	41.74		63.53	21.79	9.63
0.578000	36.21		56.00	19.79	9.65
0.626000		26.05	46.00	19.95	9.65
1.538000	28.79		56.00	27.21	9.67
3.462000	26.89		56.00	29.11	9.71
8.150000	30.99		60.00	29.01	9.84
16.458000	26.40		60.00	33.60	9.93



8.3 6dB & 99% Bandwidth

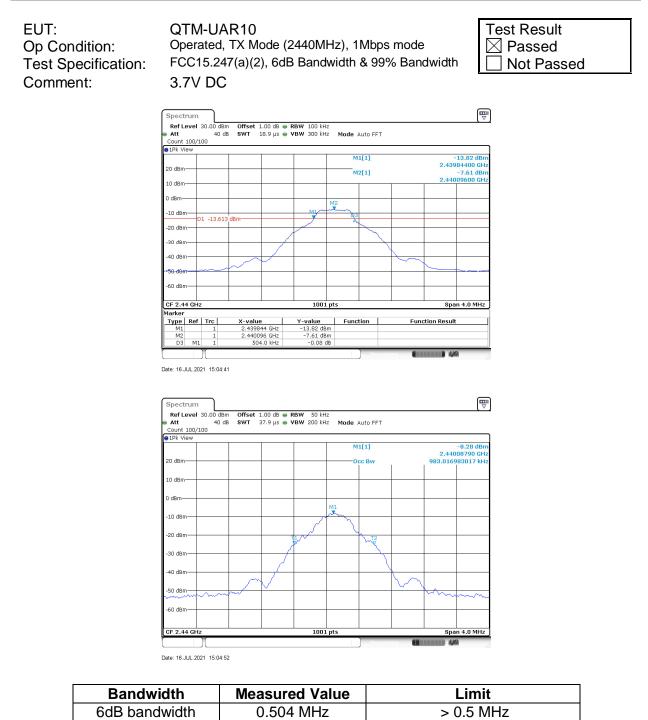


Bandwidth	Measured Value	Limit
6dB bandwidth	0.504 MHz	> 0.5MHz
99% OCB	0.951 MHz	NA

99% OCB



6dB & 99% Bandwidth



NA

0.983 MHz



Test Result

⊠ Passed

Not Passed

6dB & 99% Bandwidth

EUT: Op Condition: Test Specification: Comment:

QTM-UAR10

Operated, TX Mode (2480MHz), 1Mbps mode FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth 3.7V DC

Specti Ref Le		L 30.00	dBm Offset 1.00 dB	B - RBW 100	kHz				Ū
Att		4		• VBW 300		Auto FFT			
Count :		00							
JIPK VR	ew				1	41[1]		-	13.80 dBr
20 dBm-									84400 GH
20 Ubilli					P	42[1]			-7.65 dBi
10 dBm-	_				_	-	-	2.480	10000 GH
0 dBm—					M2				
-10 dBm				MJ		-			
		1 -13.	648 dBm		7	Š.			
-20 dBm						1			
-30 dBm				/					
							\checkmark		
-40 dBm							\sim		
-50 dBm	\sim	~	~~					m	
-50 0011									
-60 dBm						-			
CF 2.48	3 GHz			10	01 pts			Spa	n 4.0 MHz
1arker									
Type M1	Ref	Trc 1	2.479844 GH	Y-value -13.80		ction	Fund	tion Result	
M1 M2		1	2.479844 GH2 2.4801 GH2						
D3	M1	1	504.0 kHz						

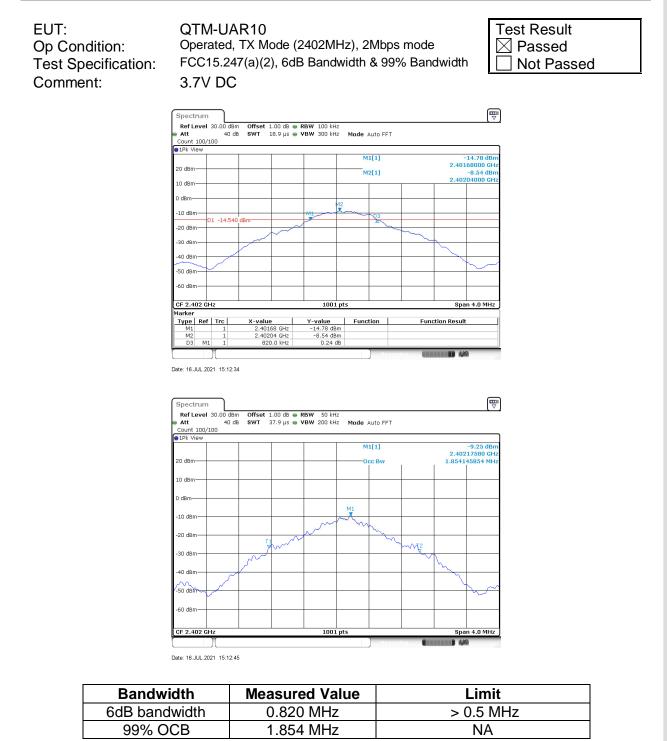
Date: 16.JUL.2021 15:06:40



BandwidthMeasured ValueLimit6dB bandwidth0.504 MHz> 0.5 MHz99% OCB0.959 MHzNA

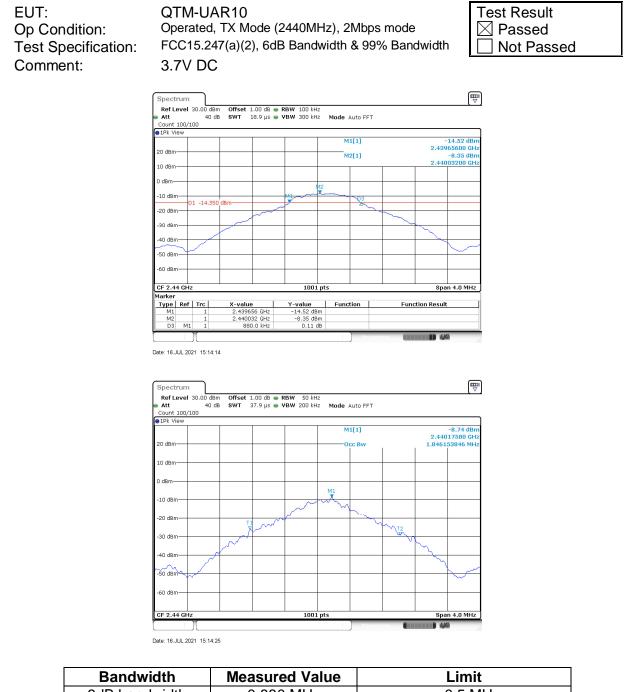


6dB & 99% Bandwidth





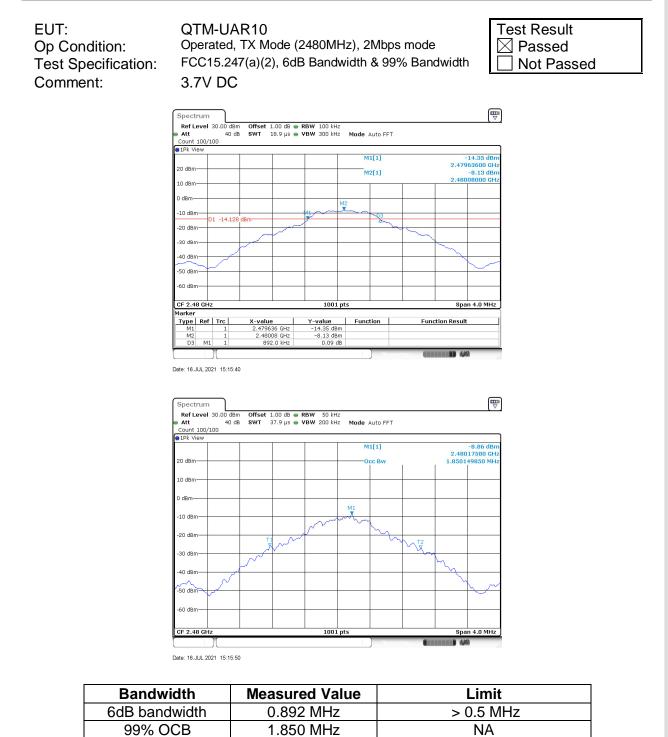
6dB & 99% Bandwidth



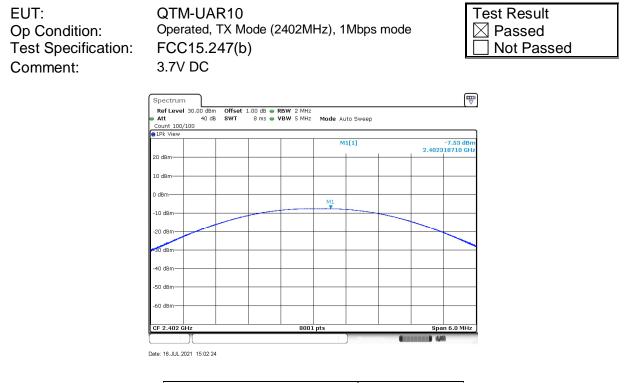
6dB bandwidth	0.880 MHz	> 0.5 MHz
99% OCB	1.846 MHz	NA



6dB & 99% Bandwidth







Conducted Output Power	Limit
-7.53 dBm	< 30dBm



EUT: Op Condition: Test Specification: Comment:	QTM-UAR10 Operated, TX Mode (2440MHz), 1Mbps modeTest Result
	Spectrum 🕎
	RefLevel 30.00 dBm Offset 1.00 dB 🖷 RBW 2 MHz
	Att 40 dB SWT 8 ms
	20 dBm
	20 08/1
	10 dBm
	0 d8m
	M1
	-10 dBm
	-20 d8m
	NO dBm
	-40 d8m-
	-50 d8m
	-60 dBm
	-ou ubili
	CF 2.44 GHz 8001 pts Span 6.0 MHz
	Measuring 🗰 Baserer) 🦇
	Date: 16.JUL_2021 15:04:58

Conducted Output Power	Limit
-7.07 dBm	< 30dBm



EUT: Op Condition: Test Specification: Comment:	QTM-UAR10 Operated, TX Mode (2480MHz), 1Mbps modeTest Result
	Spectrum 🕎
	Att 40 dB SWT 8 ms VBW 5 MHz Mode Auto Sweep
	Count 100/100
	Plk View M1[1] -7.10 dBm
	20 dBm
	10 dBm
	0 dBm
	-10 dBm
	-20 dBm
	<30 d8m
	-40 dBm
	-50 d8m
	-60 dBm-
	CF 2.48 GHz 8001 pts Span 6.0 MHz
	Measuring (California) (Ma
	Date: 16.JUL 2021 15:06:57
	Conducted Output Power Limit

Conducted Output Power	Limit
-7.10 dBm	< 30dBm



EUT: Op Condition: Test Specification: Comment:	QTM-UAR10 Operated, TX Mode (2402MHz), 2Mbps mode FCC15.247(b) 3.7V DC
	Spectrum 🕎
	Ref Level 30.00 dBm Offset 1.00 dB 🖷 RBW 2 MHz
	Count 100/100
	●1Pk View M1[1] -7.61 dBm
	20 dBm
	10 dBm
	0 dBm
	-10 dBm
	-20 dBm
	-30 dBm
	-40 d8m
	-50 d8m
	-iliau uc-
	-60 dBm
	CF 2.402 GHz 8001 pts Span 6.0 MHz
	Messuring (11111) (A)
	Date: 16.JUL.2021 15:12:51

Conducted Output Power	Limit
-7.61 dBm	< 30dBm



EUT: Op Condition: Test Specification: Comment:	QTM-UAR10Test ResultOperated, TX Mode (2440MHz), 2Mbps modePassedFCC15.247(b)Not Passed3.7V DC
	Spectrum 🕎
	Ref Level 30.00 dBm Offset 1.00 dB
	Att 40 dB SWT 8 ms VBW 5 MHz Mode Auto Sweep Count 100/100
	1Pk View
	20 dBm
	10.40m
	Att 40 db SWT 8 ms VBW 5 MHz Mode Auto Sweep Count 100/100 -7.05 dbm P/F. View -7.05 dbm 20 dbm 2.440442440 GHz 10 dbm -10 dbm -10 dbm -10 dbm -20 dbm -10 dbm -30 dbm -10 dbm -50 dbm -10 dbm
	-20 dBm
	-30 d8m
	40 dBm
	-50 dBm
	-60 dBm
	CF 2.44 GHz 8001 pts Span 6.0 MHz
	Date: 16.JUL.2021 15:14:31

Conducted Output Power	Limit
-7.05 dBm	< 30dBm



EUT: Op Condition: Test Specification: Comment:	QTM-UAR10 Operated, TX Mode (2480MHz), 2Mbps mode FCC15.247(b) 3.7V DC
	Spectrum 🕎
	Ref Level 30.00 dBm Offset 1.00 dB RBW 2 MHz
	Count 100/100
	●1Pk View M1[1] -7.15 dBm
	20 dBm
	10 dBm-
	0 d8m
	-10 dBm
	-10 doin
	-20 dBm
	-30 dBm
	-40 dBm
	-+0 0011
	-50 dBm
	-60 dBm
	CF 2.48 CHz 8001 pts Span 6.0 MHz
	Date: 16.JUL.2021 15:15:57

Conducted Output Power	Limit
-7.15 dBm	< 30dBm



8.5 Spurious Emissions at Antenna Terminals

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2402MHz), 1Mbps mode FCC2.1051 & 15.247(d) 3.7V DC Test Result ☐ Passed ☐ Not Passed

Channel	FreqRange MHz	RefLevel dBm	Result dBm	Limit dBm	Verdict
2402	2402	-8.36	-8.36		PASS
2402	30~1000	-8.36	-47.81	<=-28.36	PASS
2402	1000~26500	-8.36	-52.19	<=-28.36	PASS



Date: 16.JUL.2021 15:02:45



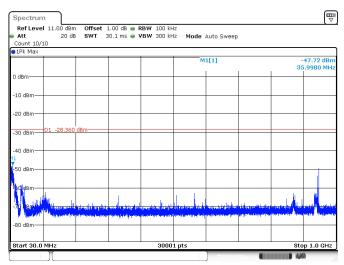
Test Result

⊠ Passed

Not Passed

Spurious Emissions at Antenna Terminals

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2402MHz), 1Mbps mode FCC2.1051 & 15.247(d) 3.7V DC



Date: 16.JUL.2021 15:02:51

52.19 di L1100 G
and so and

Date: 16.JUL.2021 15:02:59



Spurious Emissions at Antenna Terminals

EUT: QT Op Condition: Ope Test Specification: FC Comment: 3.7

QTM-UAR10 Operated, TX Mode (2440MHz), 1Mbps mode FCC2.1051 & 15.247(d) 3.7V DC

Test Result	
🛛 Passed	
Not Passed	

Channel	FreqRange MHz	RefLevel dBm	Result dBm	Limit dBm	Verdict
2440	2440	-7.49	-7.49		PASS
2440	30~1000	-7.49	-48.24	<=-27.49	PASS
2440	1000~26500	-7.49	-51.00	<=-27.49	PASS



Date: 16.JUL.2021 15:05:09



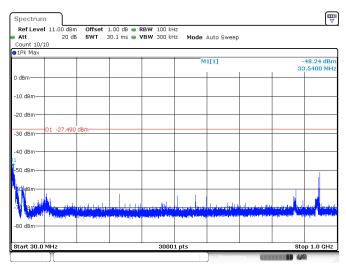
Test Result

⊠ Passed

Not Passed

Spurious Emissions at Antenna Terminals

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2440MHz), 1Mbps mode FCC2.1051 & 15.247(d) 3.7V DC



Date: 16.JUL.2021 15:05:15

Att Count 9/10	30 dB	SWT	255 ms 😑 🕻	/BW 300 kH	z Mode	Auto Sweep			
●1Pk Max									
					м	1[1]			51.00 dE
10 dBm								-	
0 dBm									
-10 dBm									
-20 dBm									
-30 dBm	01 -27,490	dBm							
00 00									
-40 dBm									
				M1					
-50 dBm					ويتعاويه المريد وال	alan shua	a de al de s	under die Bergen	
-60.de	about the barrents	when the state	Britan Birdenstaties		والالتغريان التعرين		يى مىر قىيەر يە بىر مىر قىيەر بە	p	a na na na na na
and and an other	New York Company	1. 1	and the state of the	1					
-70 dBm									

Date: 16.JUL.2021 15:05:23



Spurious Emissions at Antenna Terminals

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2480MHz), 1Mbps mode FCC2.1051 & 15.247(d) 3.7V DC

Test Result	
🛛 Passed	
Not Passed	

Channel	FreqRange MHz	RefLevel dBm	Result dBm	Limit dBm	Verdict
2480	2480	-7.82	-7.82		PASS
2480	30~1000	-7.82	-47.68	<=-27.82	PASS
2480	1000~26500	-7.82	-51.67	<=-27.82	PASS



Date: 16.JUL.2021 15:07:17



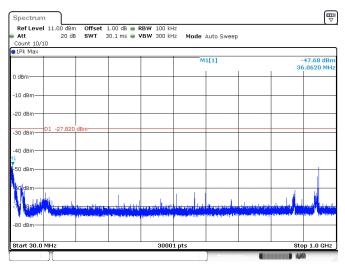
Test Result

⊠ Passed

Not Passed

Spurious Emissions at Antenna Terminals

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2480MHz), 1Mbps mode FCC2.1051 & 15.247(d) 3.7V DC



Date: 16.JUL.2021 15:07:23

	20.00 dBm		1.00 dB 👄 1						
Att Count 9/10	30 dB	SWT	255 ms 👄	VBW 300 kH	Iz Mode	Auto Sweep			
1Pk Max									
					M	1[1]		0	-51.67 di
								12.3	399350 G
10 dBm									
0 dBm									
U UDIII									
-10 dBm-									
10 0011									
-20 dBm									
-30 dBm	D1 -27.020	dBm							
-40 dBm									
				M1					
-50 dBm				Y	1				
		ALL IN COLUMN	والمتحالة المحاد	والروطر باستهامه		diat, add			برادر والانتخاص
r60ude name	and the second secon	and protection	and an article state of the	-	Contraction of the local division of the loc	And the second second	Contraction of the second	and the second	ومورث والمراب
(help the second second									
-70 dBm				1					
Start 1.0 G	Hz			. 3000	1 pts			Sto	p 26.5 G⊢

Date: 16.JUL.2021 15:07:31



Spurious Emissions at Antenna Terminals

EUT: Q Op Condition: Or Test Specification: FC Comment: 3.

QTM-UAR10 Operated, TX Mode (2402MHz), 2Mbps mode FCC2.1051 & 15.247(d) 3.7V DC

Test Result	
🛛 Passed	
Not Passed	

Channel	FreqRange MHz	RefLevel dBm	Result dBm	Limit dBm	Verdict
2402	2402	-8.60	-8.60		PASS
2402	30~1000	-8.60	-48.03	<=-28.6	PASS
2402	1000~26500	-8.60	-43.84	<=-28.6	PASS



Date: 16.JUL.2021 15:13:11

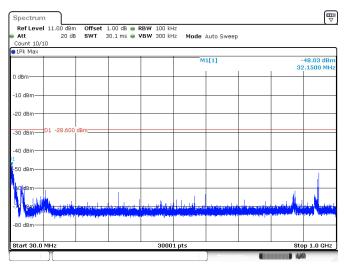


⊠ Passed

Not Passed

Spurious Emissions at Antenna Terminals

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2402MHz), 2Mbps mode FCC2.1051 & 15.247(d) 3.7V DC



Date: 16.JUL.2021 15:13:17

Att Count 9/10	30 dB SWT	255 ms 😑 🕻	/BW 300 kH	z Mode	Auto Sweep			
 1Pk Max 								
				м	1[1]			-43.84 di 99950 G
10 dBm							2.0	
0 dBm								
-10 dBm-								
-20 dBm								
-30 d6m 01 ·	28.600 dBm							
-40 d <mark>8</mark> m								
-50 dBm								
-50 usin-			والمرور أراري	م افقا ا میلار میران	different product	and the second second	Constant and the second	
-60, dBm - uhu uh	Bang daga Bang daga baga baga baga baga baga baga bag		engene og en ser som Hersen forstationet		6.49. J. a. a. a. a. a.			and a start
and the second second second								
-70 dBm								

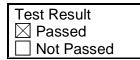
Date: 16.JUL.2021 15:13:25



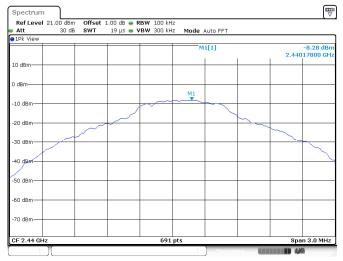
Spurious Emissions at Antenna Terminals

EUT:QTM-UAR10Op Condition:Operated, TX MTest Specification:FCC2.1051 &Comment:3.7V DC

Operated, TX Mode (2440MHz), 2Mbps mode FCC2.1051 & 15.247(d) 3.7V DC



Channel	FreqRange MHz	RefLevel dBm	Result dBm	Limit dBm	Verdict
2440	2440	-8.28	-8.28		PASS
2440	30~1000	-8.28	-47.69	<=-28.28	PASS
2440	1000~26500	-8.28	-52.01	<=-28.28	PASS



Date: 16.JUL.2021 15:14:42

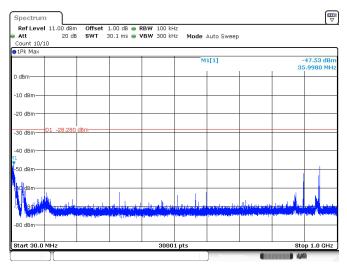


⊠ Passed

Not Passed

Spurious Emissions at Antenna Terminals

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2440MHz), 2Mbps mode FCC2.1051 & 15.247(d) 3.7V DC



Date: 16.JUL.2021 15:14:48

Att Count 9/10	30 dB	SWT	200 110 🕘 .	/BW 300 kH	Mode	Auto Sweep			
∋1Pk Max					M	1[1]			-52.01 dE
10 dBm								12.1	99600 G
0 dBm									
-10 dBm									
-20 dBm									
-30 dBm - D	1 -28.280	dBm							
-40 dBm									
-50 dBm				M1					
			and the second	والتقر اسرأي ومعا		houldle	Rolling Barres	and an Upp	تل فرسيانيا
-691de	end constants	and a second	a Baylin dia gentrikaat	ans for the part	na standa alla.	the second second	وي على الدينية. ا	and the second	na n
-70 dBm									
Start 1.0 GH	z		1	3000	1 pts	1	1	Stop) 26.5 GF

Date: 16.JUL.2021 15:14:56



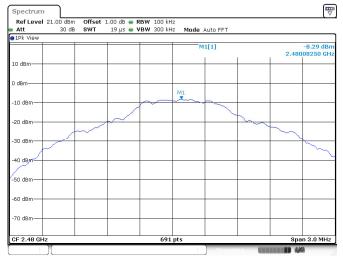
Spurious Emissions at Antenna Terminals

EUT:QTM-UAR10Op Condition:Operated, TX MTest Specification:FCC2.1051 &Comment:3.7V DC

Operated, TX Mode (24480MHz), 2Mbps mode FCC2.1051 & 15.247(d) 3.7V DC

Test Result	
imes Passed	
Not Passed	

Channel	FreqRange MHz	RefLevel dBm	Result dBm	Limit dBm	Verdict
2480	2480	-8.29	-8.29		PASS
2480	30~1000	-8.29	-38.93	<=-28.29	PASS
2480	1000~26500	-8.29	-52.1	<=-28.29	PASS



Date: 16.JUL.2021 15:16:17

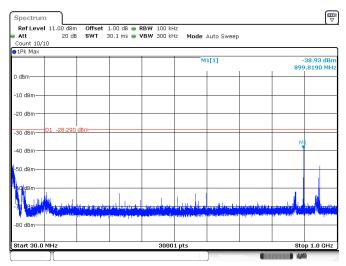


⊠ Passed

Not Passed

Spurious Emissions at Antenna Terminals

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2480MHz), 1Mbps mode FCC2.1051 & 15.247(d) 3.7V DC



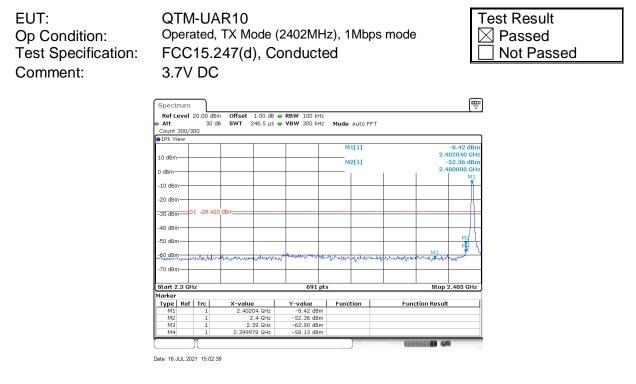
Date: 16.JUL.2021 15:16:23

Att 🗧	20.00 dBm 30 dB		1.00 dB 👄 H 255 ms 👄 V			Auto Sweep			
Count 9/10 1Pk Max									
TEK MOA					м	1[1]			-52.10 di 799350 G
10 dBm									1
0 dBm									
-10 dBm									
-20 dBm									
-30 dBm	D1 -28.290	dBm							
-40 dBm									
-50 dBm					M1				
	المعمومة ورده	line and a start	and the second states	الرجار الراوط والمراجع	an ha sha a sha	and an inclusion of the state o	مهادنا وطغار	and the second second	In the Institution
-60.dB	u pastineteri	An and An and Andrews	and the second shares	(AND AND AND AND AND AND AND AND AND AND					-
-70 dBm									

Date: 16.JUL.2021 15:16:31



8.6 100kHz Bandwidth of band edges



Band edges	Limit
43.94 dB	> 20dB



 \boxtimes Passed

Not Passed

100kHz Bandwidth of band edges

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2480MHz), 1Mbps mode FCC15.247(d), Conducted 3.7V DC

Spectrun							,
Ref Leve	20.00 dBr 30 d						
Count 300.		B SWI 1.1 ms	VBW 300 kH	IZ MODE AU	ito Sweep		
1Pk View	1300						
ALC: NOT				M1	[1]		-7.80 dB
10 dBm							2.480130 G
10 asm				M2	[1]		-59.28 dB
0 dBm							2.483500 GH
o upin	M1				1	1	
-10 dBm	1						
					1		
-20 dBm							
-30 dBm	D1 -27.800) dBm					
-30 asm	1						
-40 dBm							
	11						
-50 dBm	+				M	4	
	M2		M3				
-60 d8m****		a a a a a a a a a a a a a a a a a a a	and the second second		the state of the s		,
-70 dBm							
/0 0011							
Start 2.47	GHz		691	nts			Stop 2.55 GH
1arker	GITE		0,71	pes			0100 2100 011
	f Trc	X-value	Y-value	Functi	on	Eunct	ion Result
M1	1	2.48013 GHz	-7.80 dE			7 41100	
M2	1	2.4835 GHz	-59.28 dB	3m			
M3	1	2.5 GHz	-59.21 dB				
M4	1	2.52658 GHz	-57.33 dB	3m			

Date: 16.JUL.2021 15:07:12

Band edges	Limit
51.48 dB	> 20dB



 \boxtimes Passed

Not Passed

100kHz Bandwidth of band edges

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2402MHz), 2Mbps mode FCC15.247(d), Conducted 3.7V DC

Ref Le	evel	20.00 dB	m Offset	1.00 dB	• RBW 100 kHz				
Att		30 0	ib SWT 2	46.5 µs (• VBW 300 kHz	Mode Auto	FFT		
Count :	300/3	00							
1Pk Vi	вw								
						M1[1]			-9.12 dB
0 dBm									02190 G
						M2[1]			16.90 dE
dBm-							1	2.40	10000 G
									M
10 dBm								-	
n dBm									
cu ubii									
i0 dBm		1 -29.12	0 dBm						
0 0011			1						
40 dBm									
									M
50 dBm									
0 d0m								M3	
6,680	m	magnets	helpermann	mann	Mar Martin	-mount fulled	mander	marken append	were
'0 dBm	-								
tart 2	3.61	7			691 pt	<u>د</u>		Stop 2	.405 G⊦
arker	.0 01				051 p	3		000 2	. 100 di
Type	Pof	Trc	X-value		Y-value	Function	1 50	Inction Result	
M1	Ker	1		19 GHz	-9.12 dBm	Tunction	1 14	necion Result	
M2		1		.4 GHz	-46.90 dBm				
M3		1		39 GHz	-62.85 dBm				
M4		1	2.3999	70.00	-50.54 dBm				

Date: 16.JUL.2021 15:13:06

Band edges	Limit
37.78 dB	> 20dB



 \boxtimes Passed

Not Passed

100kHz Bandwidth of band edges

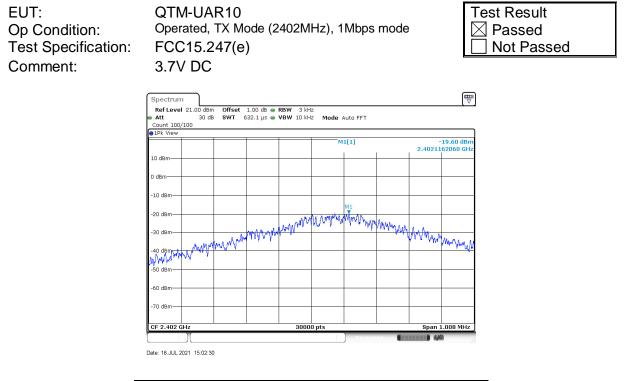
EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode (2480MHz), 2Mbps mode FCC15.247(d), Conducted 3.7V DC

Spectrum									R
Ref Level Att Count 300/3	30 di			RBW 100 kH: VBW 300 kH:		Auto Sv	veep		•
∋1Pk View									
					M	1[1]			-8.38 dBr 80130 GH
10 dBm					м	2[1]			+80130 GF -58.41 dBi +83500 GF
0 dBm	M1					1			
-10 dBm	Ă			-				-	
-20 dBm	Д—						_		
-30 dBm — C	01 -28.380) dBm							
-40 dBm	h h								
-so dam	M2M4	t amingan the	M3		بالمحاجب والمراجع				-
-70 dBm									
Start 2.47 0	GHz			691	pts			Sto	2.55 GHz
Marker									
	Trc	X-value		Y-value	Func	tion	Fu	nction Resul	t
M1	1	2.48013		-8.38 dB					
M2	1	2.4835		-58.41 dB					
M3 M4	1	2.5	5 GHz	-59.96 dB -57.13 dB					
M4	1	2.485072	GHZ	-57.13 dB					

Date: 16.JUL.2021 15:16:11

Band edges	Limit
50.03 dB	> 20dB





PSD	Limit
-19.60 dBm/3kHz	< 8 dBm/3kHz



EUT: Op Condition: Test Specification: Comment:	QTM-UAR10 Operated, TX Mode (2440MHz), 1Mbps modeTest Result ⊠ Passed □ Not PassedFCC15.247(e) 3.7V DCNot Passed
	Spectrum
	RefLevel 21.00 dBm Offset 1.00 dB RBW 3 kHz Att 30 dB SWT 632.1 µs VBW 10 kHz Mode Auto FFT
	Count 100/100
	10 dBm
	0 dBm
	-10 dBm
	-20 dBm
	-20 dBm
	-so asin municipality where the second secon
	-50 dBm
	-60 dBm
	-00 UBII
	-70 dBm-
	CF 2.44 GHz 30000 pts Span 1.008 MHz
	Date: 16.JUL.2021 15:05:04
Г	

PSD	Limit
-17.9 dBm/3kHz	< 8 dBm/3kHz



EUT: Op Condition: Test Specification: Comment:	QTM-UAR10 Operated, TX Mode (2480MHz), 1Mbps mode FCC15.247(e) 3.7V DC Test Result ⊠ Passed □ Not Passed
	Spectrum 🕎
	RefLevel 21.00 dBm Offset 1.00 dB RBW 3 kHz Att 30 dB SWT 632.1 µs VBW 10 kHz Mode Auto FFT
	Count 100/100
	10 dBm
	0 dBm
	-10 dBm M1
	-30 dBm
	A sa what is not a second and a second
	TO DEP ANY WAY A CAN THE TO THE ANY
	-50 dBm
	-60 dBm
	-70 dBm-
	CF 2.48 GHz 30000 pts Span 1.008 MHz
	Measuring (Contracting) MA
	Date: 16.JUL 2021 15:07:03
_	

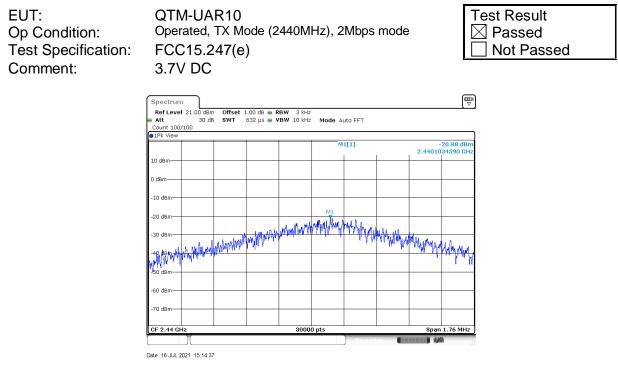
PSD	Limit
-17.51 dBm/3kHz	< 8 dBm/3kHz



EUT: Op Condition: Test Specification: Comment:	QTM-UAR10 Operated, TX Mode (2402MHz), 2Mbps modeTest Result ⊠ Passed □ Not PassedFCC15.247(e) 3.7V DCNot Passed
	Spectrum 🕎
	RefLevel 21:00 dBm Offset 1:00 dB RBW 3 kHz Att 30 dB SWT 631.9 µs VBW 10 kHz Mode Auto FFT
	Count 100/100
	10 dBm
	0 dBm
	-10 dBm
	-20 dBm
	-20 dBm
	-30 dBm
	-50 dBm
	-60 dBm
	-ou ubiii
	-70 dBm
	CF 2.402 GHz 30000 pts Span 1.64 MHz
	Measuring.
	Date: 16.JUL.2021 15.12.57

PSD	Limit
-21.32 dBm/3kHz	< 8 dBm/3kHz





PSD	Limit
-20.88 dBm/3kHz	< 8 dBm/3kHz



EUT: Op Condition: Test Specification: Comment:	QTM-UAR10 Operated, TX Mode (2480MHz), 2Mbps modeTest Result ⊠ Passed □ Not PassedFCC15.247(e) 3.7V DC□ Not Passed
	Spectrum 🕎
	RefLevel 21.00 dBm Offset 1.00 dB RBW 3 kHz Att 30 dB SWT 632 µs VBW 10 kHz Mode Auto FFT
	Count 100/100 PIPk View
	M1[1] -21.76 dBm 2.4801439990 GHz
	10 dBm
	0 dBm
	-10 dBm
	-20 dBm
	-30 dBm
	Without An
	-50 d8m
	-60 dBm-
	-70 dBm
	CF 2.48 GHz 30000 pts Span 1.784 MHz
	Orizero di zero di zero Oddob pris Oppini zero di mizero Measurine Measurine Measurine
	Date: 16.JUL 2021 15:16:02

PSD	Limit
-21.76 dBm/3kHz	< 8 dBm/3kHz



8.8 Antenna Requirement

EUT: Op Condition: Test Specification: Comment: QTM-UAR10 Operated, TX Mode FCC15.203 & 15.247(b) 3.7V DC

Test Result	
🛛 Passed	
Not Passed	

Limit

For intentional device, according to FCC Title 47 Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC Title 47 Part 15.247(b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The antenna used in this product is a ceramic chip antenna welded on PCB, and the maximum gain of this antenna is 5.46 dBi.



9 Test setup procedure

9.1 Spurious Radiated Emission

Test Method

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.

3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

5: Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 KHz to 120KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz a) RBW = 1MHz.

b) VBW $\ [3 \times RBW]$.

c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.

d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:



1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is $[10 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels. 2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels. 3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section RSS-GEN 8.10, must comply with the radiated emission limits specified in section 15.209.

 Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
 30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.



9.2 Conducted Emission at AC Power line

Test Method

- 1. The EUT was placed on a table, which is 0.8m above ground plane
- 2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
- 3. Maximum procedure was performed to ensure EUT compliance
- 4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

According to §15.207 & RSS-GEN 8.8, conducted emissions limit as below:

Frequ Mi	•	QP Limit dBµV	AV Limit dBµV
0.150	0.500	66-56*	56-46*
0.50	0-5	56	46
5-	30	60	50

Remark: "*" Decreasing linearly with logarithm of the frequency



9.3 6dB & 99% Bandwidth

Test Method

1. Use the following spectrum analyzer settings:

RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold 2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be \geq 6 dB.

3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]

≥500



9.4 Peak Output Power

Test Method

- 1. Connect the spectrum analyzer to the EUT
 - a) The EUT is configured to transmit continuously, or to transmit with a constant duty factor.
 - b) At all times the EUT is transmitting at its maximum power control level.
 - c) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- 2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
- 3. Adjust the measurement in dBm by adding 10log (1/x), where x is the duty cycle to the measurement result.

Limits

According to §15.247 (b) (1) & RSS-247 5.4(d), conducted peak output power limit as below:

	Frequency Range MHz	Limit W	Limit dBm
	2400-2483.5	≤1	≤30
For e.i r.p:			
	Frequency Range MHz	Limit W	Limit dBm
	2400-2483.5	≤4	≤30



9.5 Spurious Emissions at Antenna Terminals

Test Method

- 1. Establish a reference level by using the following procedure:
 - a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
 - b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
- 2. Use the maximum PSD level to establish the reference level.
 - a. Set the center frequency and span to encompass frequency range to be measured.
 - b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
- 3. Repeat above procedures until other frequencies measured were completed.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20



9.6 100kHz Bandwidth of band edges

Test Method

1 Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz, VBW \ge RBW, Sweep = auto, Detector function = peak, Trace = max hold.

- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20



Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

- Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
- 2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
- 3. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3KHz]

≤8



10 Appendix A - General Product Information

Radiofrequency radiation exposure evaluation

This exposure evaluation is intended for FCC ID: 2AX6LQTMUR10

According to KDB 447498 D01v06 section 4.3.1, For frequencies between 100 MHz to 6GHz and test separation distances \leq 50 mm, the Numeric threshold is determined as:

Step a)

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] $\cdot [\sqrt{f(GHz)}] \le 3.0$ for 1-g SAR

>> The fundamental frequency of the EUT is 2402-2480MHz, the test separation distance is ≤ 50mm. (Here calculated it as the worst-case, define the distance is 5mm)

Step b)

- >> Numeric threshold (2402MHz), mW / 5mm * $\sqrt{2.402GHz} \le 3.0$ Numeric threshold (2402MHz) $\le 9.678mW$
- >> Numeric threshold (2440MHz), mW / 5mm * $\sqrt{2.440GHz} \le 3.0$ Numeric threshold (2440MHz) $\le 9.602mW$
- >> Numeric threshold (2480MHz), mW / 5mm * $\sqrt{2.480GHz} \le 3.0$ Numeric threshold (2480MHz) $\le 9.525mW$
- >> The power (measured + tune up tolerance) of EUT at 2402MHz is: -7.53dBm = 0.177mW The power (measured + tune up tolerance) of EUT at 2440MHz is: -7.05dBm = 0.197mW The power (measured + tune up tolerance) of EUT at 2480MHz is: -7.10dBm = 0.195mW

Which is smaller than the Numeric threshold. Therefore, the device is exempt from stand-alone SAR test requirements.

Reviewed by:

Eric LI EMC Project Manager

Prepared by:

Hosea CHAN EMC Project Engineer



11 Appendix B - Declaration Letters

Declaration Letter of Model Difference



3120-12 St NE Calgary, Alberta, Canada T2E 813 Ph: (403) 536 – 0775 Web: www.zerokey.com

To: TÜV SÜD Hong Kong Limited

 Attention:
 Eric Li

 From:
 Matthew Lowe
 Date: November 25, 2021

 Fax No:
 Total Page (Cover Included): 1

 Project No.:
 5503655

 Subject:
 Declaration letter of model difference

We: ZEROKEY INC. 3120 12TH ST NE, CALGARY ALBERTA, CANADA T2E 8T3

Officially notify TÜV SÜV Hong Kong Limited that the <<u><<Model A>></u> have the same technical construction including circuit diagram, PCB Layout, components and component layout, all electrical construction and mechanical construction, with <u><<PRODUCT>></u>, <u><<Model B>></u>. The difference between them is showing in the following table.

<<Model A>>: QTM-UMR10, QTM-SMR10

<<Model B>>: QTM-UAR10

<<Product>>: Quantum RTLS Universal Anchor/Mobile/Tag

The following table show the details of the difference between these three models.

Model	1.55 St. 155	Differences	Similanties
QTM-UAR10	Anchor unit	Universal node case with basic PCB population	All these three models use exactly the same PCB board with same components and
QTM-UMR10 Mobile unit		Universal node case with added MEMS sensors	component layout. QTM-UAR10 and QTM-UMR10 have same
QTM-SMR10	Clip-on Tag	Orange case with clip, vibrator and, beeper comparing with QTM-UAR10	enclosure, QTM-SMR10 has a different enclosure.

Applicant:

Matthew Lowe

November 25, 2021 (Date)

(Applicant's authorized signature and company Chop)

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