

ROIDMI Information Technology Co., Ltd RF TEST REPORT

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FCC Part 15.247 & ISED RSS-247 RF report

Model: XCQ28RM

REPORT NUMBER 200800347SHA-001

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FCC ID	:	2AR98-XCQ28RM
IC	:	26376-XCQ28RM

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification: 47CFR Part 15 (2019): Radio Frequency Devices (Subpart C)

ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

RSS-247 Issue 2 (February 2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 5 (March 2019) Amendment 1: General Requirements for Compliance of Radio Apparatus

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emb

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Revision History

Report No.	Version	Description	Issued Date
200800347SHA-001	Rev. 01	Initial issue of report	September 14, 2020

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TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
Minimum 6dB Bandwidth	15.247(a)(2)	RSS-247 Issue 2 Clause 5.2	Pass
Maximum conducted output power and e.i.r.p.	15.247(b)(3)	RSS-247 Issue 2 Clause 5.4	Pass
Power spectrum density	15.247(e)	RSS-247 Issue 2 Clause 5.2	Pass
Emission outside the frequency band	15.247(d)	RSS-247 Issue 2 Clause 5.5	Pass
Radiated Emissions in restricted frequency bands	15.247(d), 15.205&15.209	RSS-Gen Issue 5 Clause 8.9&8.10	Pass
Power line conducted emission	15.207(a)	RSS-Gen Issue 5 Clause 8.8	Pass
Occupied bandwidth	-	RSS-Gen Issue 5 Clause 6.6	Tested
Antenna requirement	15.203	-	Pass

Notes: 1: NA =Not Applicable

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1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	Cordless Vacuum Cleaner	
Type/Model:	XCQ28RM	
The EUT is a Cordless Vacuum Cleaner with BLE function. The Description of EUT: one model and the worst test results are listed		
	Battery: 28.8V DC Adaptor:	
Rating:	Input: 100V-240V~, 50-60Hz, 1.0A; Output: 34.2VDC, 1.0A	
EUT type:	Table top 🛛 Floor standing	
Software Version:	/	
Hardware Version: /		
Sample received date: August 13, 2020		
Date of test:	August 13 ~ September 10, 2020	

1.2 Technical Specification

Frequency Band:	2400MHz to 2483.5MHz
Support Standards:	Bluetooth Low Energy 4.2
Operating Frequency:	2402MHz to 2480MHz
Type of Modulation:	GFSK
Channel Number:	40
Channel Separation:	2MHz
Antenna Information:	PCB Antenna, 2dBi



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1.3 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized,	CNAS Accreditation Lab Registration No. CNAS L0139
certified, or accredited by these	FCC Accredited Lab Designation Number: CN1175
organizations:	IC Registration Lab CAB identifier.: CN0051
	VCCI Registration Lab Registration No.: R-14243, G-10845, C-14723, T-12252
	A2LA Accreditation Lab Certificate Number: 3309.02

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2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2019) ANSI C63.10 (2013) KDB 558074 (v05r02) RSS-247 Issue 2 (February 2017) RSS-Gen Issue 5 (March 2019) Amendment 1

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

Software name	Manufacturer	Version	Supplied by
EMI_Test_Tool Telink Semiconductor		V1.8	Client

	Frequency Band (MHz)			2402 ~ 2480			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

The lowest, middle and highest channel were tested as representatives.

Data rate and Power setting:

The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases.

Frequency Band (MHz)	Mode	Data rate	Worst Data rate
2400-2483.5	BLE	1Mbps	1Mbps

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Power Setting parameter					
Working Mode	BLE				
Test Channel	2402MHz	2440MHz	2480MHz		
Power Setting	0dBm	0dBm	0dBm		

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2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

ltem No.	Name	Band and Model	Description
1	Laptop computer	DELL 5480	-

2.5 Test environment condition:

Test items	Temperature	Humidity	
Minimum 6dB Bandwidth			
Maximum conducted output power and e.i.r.p.			
Power spectrum density	22°C	54%RH	
Emission outside the frequency band			
Occupied bandwidth			
Radiated Emissions in restricted frequency bands	24°C	56%RH	
Power line conducted emission	23°C	56%RH	

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2.6 Instrument list

Conducted	Emission				
Used	Equipment	Manufacturer	Туре	Internal no.	Due date
\square	Test Receiver	R&S	ESCS 30	EC 2107	2021-07-8
\square	A.M.N.	R&S	ESH2-Z5	EC 3119	2020-11-10
	A.M.N.	R&S	ENV 216	EC 3393	2021-07-8
	A.M.N.	R&S	ENV4200	EC 3558	2021-06-11
Radiated E	mission				
Used	Equipment	Manufacturer	Туре	Internal no.	Due date
\square	Test Receiver	R&S	ESIB 26	EC 3045	2021-09-16
\square	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2021-9-25
	Pre-amplifier	R&S	AFS42- 00101800-25-S- 42	EC5262	2021-06-11
	Horn antenna	R&S	HF 906	EC 3049	2021-1-17
	Horn antenna	ETS	3117	EC 4792-1	2021-03-15
\square	Horn antenna	ΤΟΥΟ	HAP18-26W	EC 4792-3	2021-07-09
	Active loop antenna	Schwarzbeck	FMZB1519	EC 5345	2021-03-24
RF test					
Used	Equipment	Manufacturer	Туре	Internal no.	Due date
\square	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2021-03-16
	Power sensor	Agilent	U2021XA	EC 5338-1	2021-03-16
	Vector Signal Generator	Agilent	N5182B	EC 5175	2021-03-16
	Universal Radio Communication Tester	R&S	CMW500	EC5944	2020-12-9
	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2021-03-16
	Mobile Test System	Litepoint	lqxel	EC 5176	2021-01-16
	Test Receiver	R&S	ESCI 7	EC 4501	2020-09-16
	Climate chamber	GWS	MT3065	EC 6021	2021-03-05
\square	Spectrum Analyzer	Keysight	N9030B	EC 6078	2021-6-10
Tet Site					
Used	Equipment	Manufacturer	Туре	Internal no.	Due date
\square	Shielded room	Zhongyu	-	EC 2838	2021-01-12
	Shielded room	Zhongyu	-	EC 2839	2021-01-12

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	Semi-anechoic chamber	Albatross project	-	EC 3048	2021-07-14
	Fully-anechoic chamber	Albatross project	-	EC 3047	2021-07-14
Additional	instrument				
Used	Equipment	Manufacturer	Туре	Internal no.	Due date
	Therom- Hygrograph	ZJ1-2A	S.M.I.F.	EC 3783	2021-03-03
	Therom- Hygrograph	ZJ1-2A	S.M.I.F.	EC 3481	2021-01-05
	Therom- Hygrograph	ZJ1-2A	S.M.I.F.	EC 3442	2021-01-05
	Therom- Hygrograph	ZJ1-2A	S.M.I.F.	EC 3324	2021-09-05
	Pressure meter	YM3	Shanghai Mengde	EC 3320	2021-07-14

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2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Measurement uncertainty
Maximum peak output power	\pm 0.74dB
Radiated Emissions in restricted frequency bands below 1GHz	\pm 4.90dB
Radiated Emissions in restricted frequency bands above 1GHz	± 5.02dB
Emission outside the frequency band	± 2.89dB
Power line conducted emission	± 3.19dB

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3 Minimum 6dB bandwidth

Test result: Pass

3.1 Limit

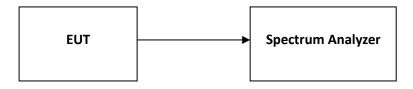
For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Measurement Procedure

The EUT was tested according to Subclause 11.8 of ANSI C63.10.

- a) Set RBW = 100 kHz.
- b) Set VBW \geq 3 × RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

3.3 Test Configuration



3.4 Test Results of Minimum 6dB bandwidth

TEST REPORT

4 Maximum conducted output power and e.i.r.p.

Test result: Pass

4.1 Limit

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 W. (The e.i.r.p. shall not exceed 4 W)

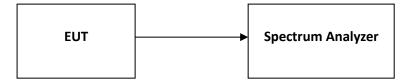
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 30dBm and 30+ (6 –antenna gain-beam forming gain).

4.2 Measurement Procedure

The EUT was tested according to Subclause 11.9.1.1 of ANSI C63.10.

- a) Set the RBW \geq DTS bandwidth.
- b) Set VBW \geq 3 × RBW.
- c) Set span \geq 3 x RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

4.3 Test Configuration



4.4 Test Results of Maximum conducted output power

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5 **Power spectrum density**

Test result: Pass

5.1 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

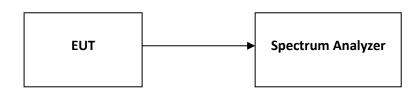
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/MHz and 8+ (6 –antenna gain-beam forming gain).

5.2 Measurement Procedure

The EUT was tested according to Subclause 11.10 of ANSI C63.10.

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW \geq 3 × RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3 Test Configuration



5.4 Test Results of Power spectrum density

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6 Emission outside the frequency band

Test result: Pass

6.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

6.2 Measurement Procedure

The EUT was tested according to Subclause 11.11 of ANSI C63.10.

Reference level measurement

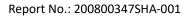
Establish a reference level by using the following procedure:

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to \geq 1.5 times the DTS bandwidth.
- c) Set the RBW = 100 kHz.
- d) Set the VBW \geq 3 x RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

Emission level measurement

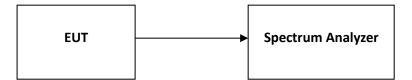
- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW \geq 3 x RBW.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine 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 specified in 11.11. Report the three highest emissions relative to the limit.



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6.3 Test Configuration



6.4 The results of Emission outside the frequency band

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7 Radiated Emissions in restricted frequency bands

Test result: Pass

7.1 Limit

The radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified showed as below:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

7.2 Measurement Procedure

The EUT was tested according to Subclause 11.12 of ANSI C63.10.

For Radiated emission below 30MHz:

- a) The EUT was placed on the top of a rotating table 0.8 meters (0.1 meters for floor-standing device) above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c) Both X and Y axes of the antenna are set to make the measurement.
- d) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

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For Radiated emission above 30MHz:

- a) The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) or 0.1 meters (for floor-standing device) above the ground at 3 meters chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c) 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.
- d) 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.
- e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

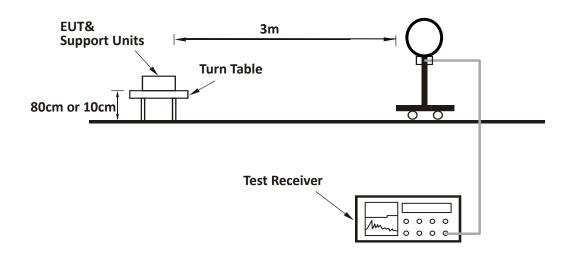
Note:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 3 x RBW (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
- 4. All modes of operation were investigated and the worst-case emissions are reported

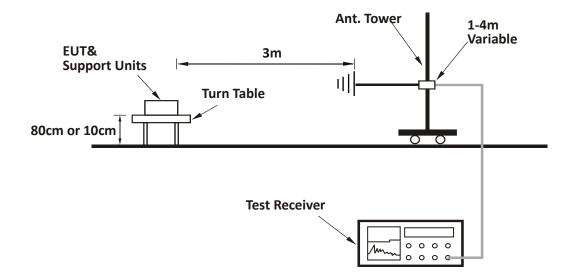
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7.3 Test Configuration

For Radiated emission below 30MHz:



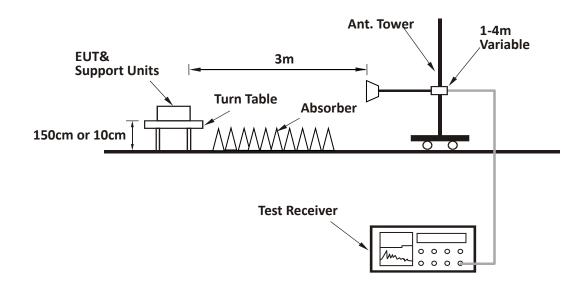
For Radiated emission 30MHz to 1GHz:





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For Radiated emission above 1GHz:



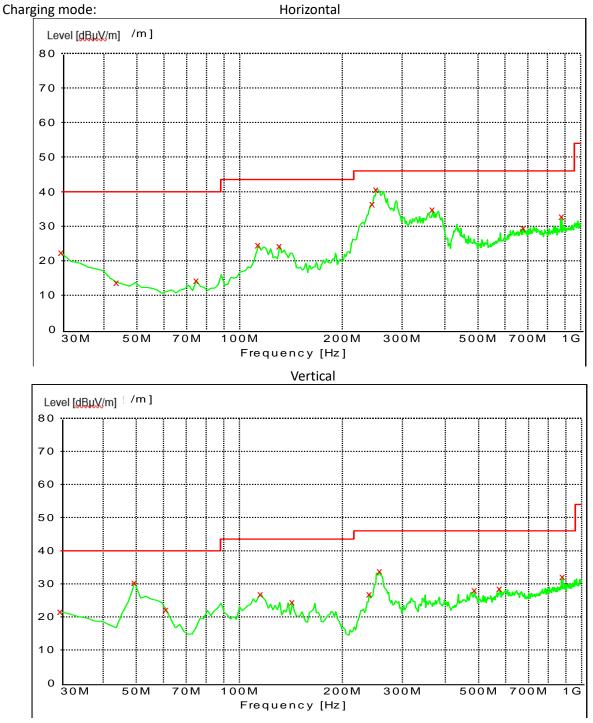
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7.4 Test Results of Radiated Emissions

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

EUT was tested with BLE on and off, and the worst data was listed in the report.

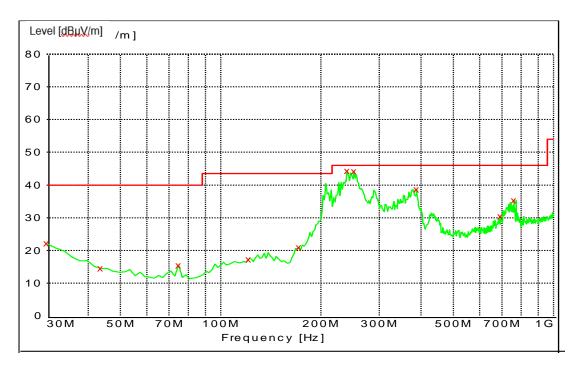
Test data below 1GHz



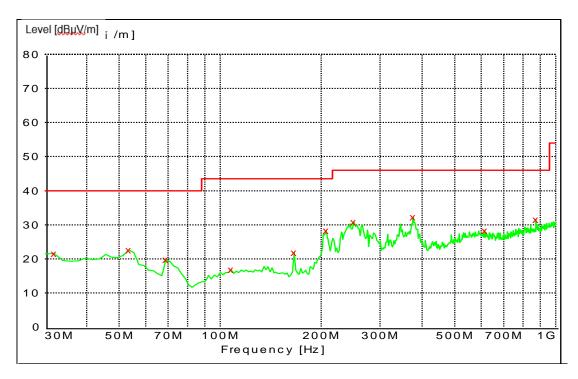
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Horizontal







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Test data below 1GHz

Charging mode:						
Antenna Polarization	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin	Detector
	30.00	22.30	19.40	40.00	17.70	РК
	245.77	36.50	13.40	46.00	9.50	РК
н	251.60	40.60	14.10	46.00	5.40	РК
п	368.24	34.80	16.70	46.00	11.20	РК
	679.26	29.50	21.40	46.00	16.50	РК
	881.42	32.80	23.50	46.00	13.20	РК
	30.00	21.50	19.40	40.00	18.50	РК
	49.44	30.40	9.20	40.00	9.60	РК
V	61.10	22.10	7.30	40.00	17.90	РК
V	257.43	33.70	14.70	46.00	12.30	РК
	576.23	28.50	20.60	46.00	17.50	РК
	881.42	32.20	23.50	46.00	13.80	РК

Working mode:

Antenna Polarization	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin	Detector
	30.00	22.10	19.40	40.00	17.90	РК
	239.94	44.40	12.70	46.00	1.60	РК
	251.60	44.20	14.10	46.00	1.80	РК
Н	387.68	38.70	17.20	46.00	7.30	РК
	692.87	30.50	21.50	46.00	15.50	РК
	760.90	35.40	22.30	46.00	10.60	РК
	31.94	21.60	18.10	40.00	18.40	РК
V	53.33	22.60	8.30	40.00	17.40	РК
	206.89	28.20	10.80	43.50	15.30	РК
	249.66	30.80	13.80	46.00	15.20	РК

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376.01	32.20	16.90	46.00	13.80	РК
873.65	31.60	23.40	46.00	14.40	РК

Test result above 1GHz:

The emission was conducted from 1GHz to 25GHz

СН	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
	Н	2402.00	32.60	80.10	Fundamental	/	PK
	V	2402.00	32.60	76.10	Fundamental	/	РК
L	Н	2390.00	31.30	50.33	74.00	23.67	РК
	V	2390.00	31.30	49.97	74.00	24.03	РК
	Н	2440.00	32.70	81.10	Fundamental	/	PK
M	V	2440.00	32.70	76.10	Fundamental	/	PK
	Н	2480.00	32.70	79.60	Fundamental	/	РК
	V	2480.00	32.70	74.50	Fundamental	/	РК
Н	Н	2483.50	31.80	49.63	74.00	22.70	РК
	V	2483.50	31.80	49.86	74.00	23.40	PK

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.

- 2. Corrected Reading = Original Receiver Reading + Correct Factor
- 3. Margin = Limit Corrected Reading
- 4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB, Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV, Limit = 40.00dBuV/m. Then Correct Factor = 30.20 + 2.00 - 32.00 = 0.20dB/m; Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m; Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

TEST REPORT

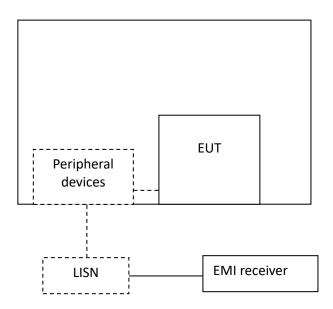
8 Power line conducted emission

Test result: Pass

8.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)				
	QP	AV			
0.15-0.5	66 to 56*	56 to 46 *			
0.5-5	56	46			
5-30	60	50			

8.2 Test Configuration



Total Quality. Assured.

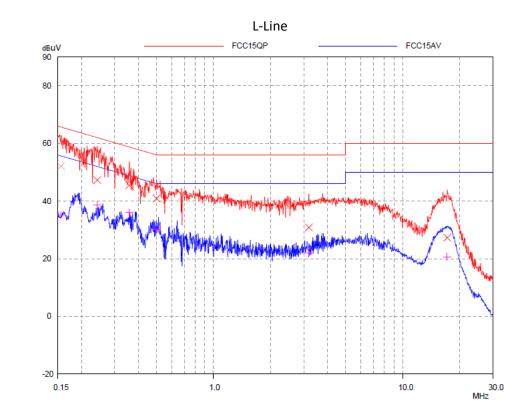
8.3 Measurement Procedure

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

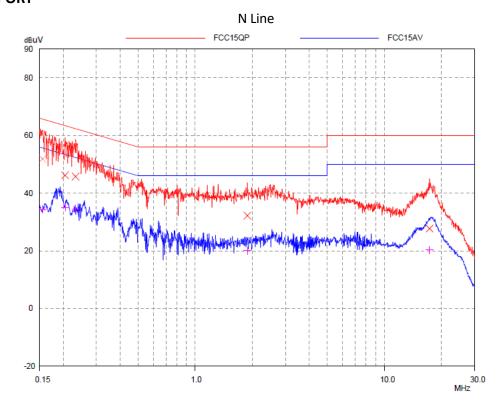
TEST REPORT



8.4 Test Results of Power line conducted emission

		Quasi-peak		Average		
Frequency (MHz)	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)
0.156	52.12	65.67	13.55	35.11	55.67	20.56
0.242	47.29	62.02	14.73	38.64	52.02	13.38
0.358	45.52	58.77	13.25	36.09	48.77	12.68
0.499	40.92	56.02	15.10	29.98	46.02	16.04
3.192	30.86	56.00	25.14	21.96	46.00	24.04
17.208	27.30	60.00	32.70	20.62	50.00	29.38
Note: * means the	ne emission l	evel 20dB be	elow the rel	evant limit.		

Total Quality. Assured.



		Quasi-peak		Average			
Frequency (MHz)	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	
0.155	51.88	65.70	13.82	34.38	55.70	21.32	
0.205	46.21	63.41	17.20	35.03	53.41	18.38	
0.233	45.75	62.35	16.60	34.52	52.35	17.83	
1.885	32.21	56.00	23.79	20.04	46.00	25.96	
17.346	27.71	60.00	32.29	20.28	50.00	29.72	
Note: * means the	ne emission l	evel 20dB be	elow the rel	evant limit.			

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

- 2. Corrected Reading = Original Receiver Reading + Correct Factor
- 3. Margin = Limit Corrected Reading
- 4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming LISN Factor = 10.00dB, Cable Loss = 2.00dB,

Original Receiver Reading = 10.00dBuV, Limit = 66.00dBuV. Then Correct Factor = 10.00 + 2.00 = 12.00dB; Corrected Reading = 10dBuV + 12.00dB = 22.00dBuV;

Margin = 66.00dBuV - 22.00dBuV = 44.00dB.

Total Quality. Assured.

9 Occupied Bandwidth

Test result: Tested

9.1 Limit

None

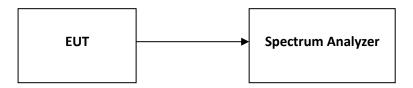
9.2 Measurement Procedure

The occupied bandwidth per RSS-Gen was measured using the Spectrum Analyzer.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

9.3 Test Configuration



9.4 The results of Occupied Bandwidth



TEST REPORT

10 Antenna requirement

Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Result:

EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section.

TEST REPORT

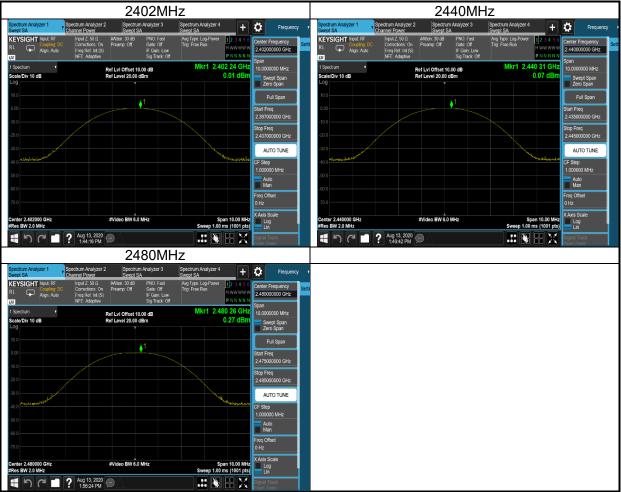
Appendix A: Test results

1. Conducted Output Power

1.1 Test Data

BLE Maximum Output Power						
Test Frequency (MHz)	Power (dBm)	Result				
2402	0.01	Pass				
2440	0.07	Pass				
2480	0.27	Pass				

BLE EIRP						
Max power (dBm) Max EIRP (dBm) Max EIRP (W) Result						
0.27	2.27	0.0016	Pass			



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Total Quality. Assured. TEST REPORT

2. Power Spectral Density

2.1 Test Data

BLE Peak Power Spectral Density						
Test Frequency (MHz) PSD (dBm/3kHz) Result						
2402	-9.44	Pass				
2440	-8.65	Pass				
2480	-8.43	Pass				

2402MHz					2440MHz								
Spectrum Analyzer 1 Swept SA	Spectrum Analyzer 2 Channel Power	2 Spectrum / Swept SA	Analyzer 3	Spectrum Analyzer Swept SA	·4 +	Ç Freque	ency v	Spectrum Analyzer 1 Swept SA	Spectrum Analyzer 2 Channel Power	Spectrum Analyzer 3 Swept SA	Spectrum Analyzer 4 Swept SA	+	Frequency
KEYSIGHT Input: RF RL Align: Auto	Corrections: On Freq Ref: Int (S) NFE: Adaptive		PNO: Best Wide Gate: Off IF Gain: Low Sig Track: Off	Avg Type. Log-Pow Trig: Free Run	er 123456 M WWWWW P N N N N N	Center Frequency 2.402000000 GHz		KEYSIGHT Input: RF RL Align: Auto	C Input Z: 50 Ω Corrections: On Freq Ref. Int (S) NFE: Adaptive	#Atten: 30 dB PNO. Best Wid Preamp: Off Gate: Off IF Gain: Low Sig Track: Off	te Avg Type: Log-Power Trig: Free Run	123456 MWWWWW PNNNNN	Center Frequency 2.440000000 GHz Soan
1 Spectrum Scale/Div 10 dB Log 10.0		Ref Lvi Offset 10.0 Ref Level 20.00 dB		Mkr1 2.40	2 073 9 GHz -9.44 dBm	Span 1.01215800 MHz Swept Span Zero Span Full Span		1 Spectrum Scale/Div 10 dB Log 10.0		Ref Lvi Offset 10.00 dB Ref Level 20.00 dBm	Mkr1 2.439	817 8 GHz -8.66 dBm	Span 1.00649200 MHz Swept Span Zero Span Full Span
-10.0	Alexandra Josephia	eghan daamad daa	1 Produce Walker	un worked have the free		Start Freq 2.401493921 GHz Stop Freq		-10.0	1 mm Mindlan	mydrafidaen Vargentaidae gaardella	when my man		Start Freq 2.439496754 GHz Stop Freq
-20.0 m ¹ /					and the for th	2.402506079 GHz AUTO TUNE CF Step 101.216 kHz		-20 0				and and a second	2.440503246 GHz AUTO TUNE CF Step 100.649 kHz
						Auto Man Freq Offset 0 Hz		-50 0					Auto Man Freq Offset 0 Hz
Center 2.4020000 GHz #Res BW 3.0 kHz		#Video BW 10 kl	Hz		Span 1.012 MHz 73 ms (1001 pts)	X Axis Scale Log Lin		Center 2.4400000 GHz #Res BW 3.0 kHz		#Video BW 10 kHz		oan 1.006 MHz ms (1001 pts	
pectrum Analyzer 1 wept SA IEYSIGHT Input. RF	Spectrum Analyzer 2 Channel Power Input Z: 50 Ω Corrections: On	248 Spectrum / Swept SA #Atten: 30 dB	PNO: Best Wide Gate: Off	Spectrum Analyzer Swept SA	·4 +	Freque	Setti		Aug 13, 2020 1:50:16 PM				USpen Zoom)
L Align: Auto Cale/Div 10 dB	NFE: Adaptive	Ref Lvi Offset 10.0 Ref Level 20.00 dB		Mkr1 2.47	9 952 7 GHz -8.43 dBm	2.48000000 GHz Span 1.00608600 MHz Swept Span Zero Span Full Span Start Freq							
000 000	person der mar an	n na star till ann an till An till ann an ti	ulanaqAmriq	KMAYN ALWKN	militannannan	2.479496957 GHz Stop Freq 2.480503043 GHz AUTO TUNE							
						CF Step 100.609 kHz Auto Man Freq Offset 0 Hz							
enter 2.4800000 GHz Res BW 3.0 kHz		#Video BW 10 ki	Hz		Span 1.006 MHz 73 ms (1001 pts)	X Avis Scale							
4 h C	Aug 13, 2020 1:56:58 PM	\mathbf{P}				Signal Track (Scen Zoom)							

Total Quality. Assured.

3. Minimum 6dB bandwidth

3.1 Test Data

BLE Occupied 6dB Bandwidth							
Test Frequency (MHz)	requency (MHz) Occupied Bandwidth (kHz) Resul						
2402	674.8	500	Pass				
2440	671.0	500	Pass				
2480	670.7	500	Pass				



Total Quality. Assured.

4. Occupied Bandwidth

4.1 Test Data

BLE 99% Occupied Bandwidth						
Test Frequency (MHz)	99% Occupied Bandwidth (MHz)	Result				
2402	1.0224	Pass				
2440	1.0101	Pass				
2480	1.0253	Pass				



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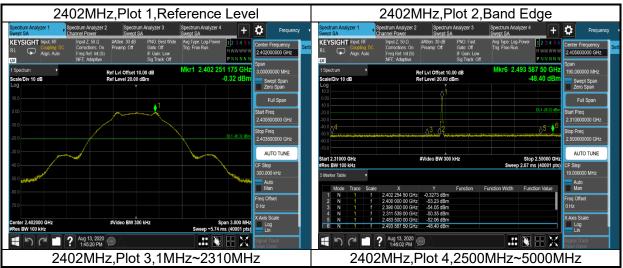
intertek Total Quality. Assured.

TEST REPORT

5. Emission outside the frequency band

5.1 Test Data

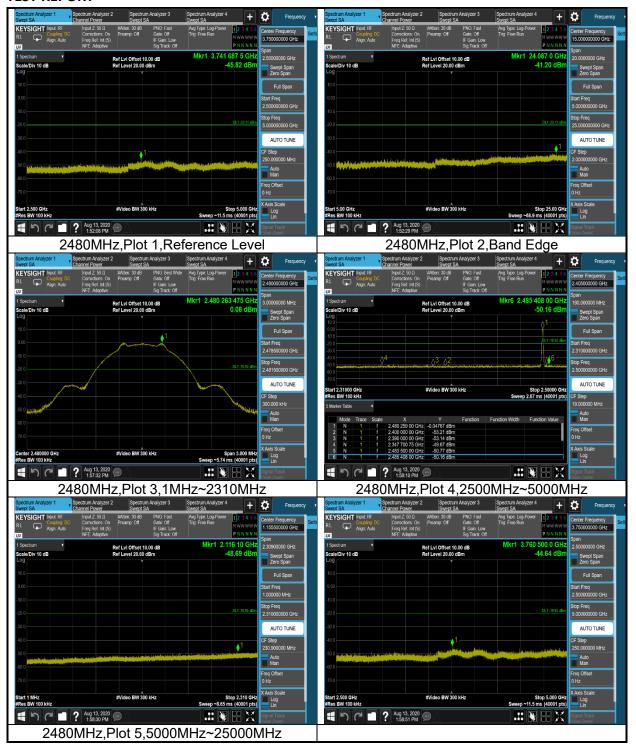
BLE Transmitter Spurious Emission						
Test Frequency (MHz)	Test Range	Power (dBm)	Result			
2402	1MHz~2310MHz	-48.98	Pass			
2402	2500MHz~5000MHz	-45.94	Pass			
2402	5000MHz~25000MHz	-41.18	Pass			
2402	Band Edge	-48.40	Pass			
2402	Reference Level	-0.32	Pass			
2440	1MHz~2310MHz	-48.85	Pass			
2440	2500MHz~5000MHz	-45.82	Pass			
2440	5000MHz~25000MHz	-41.20	Pass			
2440	Band Edge	-49.93	Pass			
2440	Reference Level	-0.11	Pass			
2480	1MHz~2310MHz	-48.69	Pass			
2480	2500MHz~5000MHz	-44.64	Pass			
2480	5000MHz~25000MHz	-41.37	Pass			
2480	Band Edge	-49.67	Pass			
2480	Reference Level	0.08	Pass			



TEST REPORT

	n Analyzer 4 + 🔅 Frequency 🔹	Spectrum Analyzer 1 Spectrum Analyzer 2 Spectrum Analyzer 3 Swept SA Swept SA	Spectrum Analyzer 4 + 🔅 Frequency
KEYSIGHT Input Z 50 Ω Antien: 30 dB PNO. Fast Ang Typ RL Coupling: DC Corrections: On Preamp: Off Gate Off Trig: Fre Align: Auto Freq Ref. Int (S) IF Gath. Control Sig Track: Off Sig Track: Off	e Run III 2 3 4 5 6 e Run WWWWW P NN N N N P NN N N N	KEYSIGHT Input. RF Input. 2 50 Ω #Atten. 30 dB PNO. Fast RL Compling DC Compositions: On Align. Auto Freq. Ref. Int (S) Preamo: Off Edito DF V3 NFE Adaptive Sig Track Off Sig Track Off	Avg Type. Log-Power Ting: Free Run M WW WW WW 2.750000000 GHz
	Mkr1 2.108 60 GHz Span 2.30900000 GHz	1 Spectrum Ref Lvi Offset 10.00 dB Scale/Div 10 dB Ref Level 20.00 dBm	Mkr1 4.067 750 0 GHz -45.94 dBm Span Swept Span
10 0	-48.98 dBm Swept Span Zero Span Full Span	Log	Zero Span Full Span
	Start Freq 1.000000 MHz	0.00	Start Freq 2.50000000 GHz
	DLI -20.32 dBm 2.310000000 GHz	-20.0	DL1 -20 32 dBm 5,00000000 GHz
	AUTO TUNE	-30.0	AUTO TUNE
	CF Step 230.900000 MHz Auto	-40.0	CF Step 250,00000 MHz
	Freq Offset	-c00 0	Man Freq Offset
tart 1 MHz #Video BW 300 kHz	0 Hz X Axis Scale Stop 2.310 GHz Log	Start 2.500 GHz #Video BW 300 kHz	Stop 5.000 GHz
Res BW 100 kHz Si	Stop 2.310 GHz Log veep ~8.65 ms (40001 pts) Lin Image: Stop 2.310 GHz Lin Image: Stop 2.310 GHz Log Image: Stop 2.310 GHz Lin Image: Stop 2.310 GHz Lin	#Res BW 100 kHz	Stop 5.000 GH2 Log Sweep ~11.5 ms (40001 pts) Lin
2402MHz,Plot 5,5000MHz		2440MHz,Plot 1,Re	
pectrum Analyzer 1 Spectrum Analyzer 2 Spectrum Analyzer 3 Spectrum Analyzer 3 Spectrum Analyzer 3 Swept SA Sw	n Analyzer 4 + 🐼 Frequency •	Spectrum Analyzer 1 Spectrum Analyzer 2 Spectrum Analyzer 3 Swept SA Channel Power Swept SA KEYSIGHT Input RF Input 2: 50 Ω #Atten: 30 dB PNO. Best Wride	Spectrum Analyzer 4 + 🐼 Frequency Awg Type. Log-Power 12 3 4 5 6 Center Frequency
EVSIGHT Input R ⁶ L Caseling DC Align: Auto Net: Adaptive L Correctors: On Preamp Off Gate: Off Preamp Off Sign: Low Net: Adaptive Sign: Correctors: On Preamp Off Sign: Correctors:	e. Log-Power e. Run M. WW WW W P. N.	KEYSIGHT Input K# Input Z 50 Ω #Atten 30 dB PNO. Best Wide RL Cauping DC Correctons: On Preamp: Off Gate: Off Algn: Auto Freq.Ret. Int (S) IF Gate: Off IF Gate: Off VX NFE: Adaptive Sig Track: Off	Ang Type: Log-Power 1 2 3 4 5 6 Trig: Free Run M WW WW W P.N.N.N.N.N Snan
Spectrum V Ref Lvi Offset 10.00 dB cale/Div 10 dB Ref Level 20.00 dBm	41.18 dBm 20.000000 GHz 20.000000 GHz 20.000000 GHz 20.000000 GHz 20.000000 GHz	1 Spectrum Ref Lvi Offset 10.00 dB Scaler/Div 10 dB Ref Level 20.00 dBm Log	Mkr1 2.439 760 900 GHz -0.11 dBm Swept Span Zero Span
	Full Span	10.0	Zero Span Full Span
	Start Freq 5.00000000 GHz		Start Freq 2.438500000 GHz
	DL1-20.32 dBm 25.000000000 GHz	-20.0	0L1-23-11 dBm Stop Freq 2.441500000 GHz
	AUTO TUNE	-30.0	AUTO TUNE
	2.00000000 GHz Auto	-50.0 WW. A.	300.000 kHz Auto Man
	Freq Offset 0 Hz	-600	Freq Offset 0 Hz
tart 5.00 GHz #Video BW 300 kHz Res BW 100 kHz Si	X Axis Scale Stop 25.00 GHz Log Lin	Center 2.440000 GHz #Video BW 300 kHz #Res BW 100 kHz	Span 3.000 MHz Sweep ~5.74 ms (40001 pts)
	veep ~68.9 ms (40001 pts)	Aug 13, 2020	Sweep 5.74 ms (4000 pbs) Lin Signal Track Signal Track Signal Track
2440MHz,Plot 2,Ban	<u> </u>	2440MHz,Plot 3,1M	
EVSIGHT input RF Input 7 50.0 #Atten 30.dB PNO Fast Ave Typ	n Analyzer 4 + Frequency • A Frequency • 2. Log-Power 12 3 4 5 6 Center Frequency Settle	Spectrum Analyzer 1 Sweet SA Sharme Power Sweet SA KEYSIGHT Input. RF Input 2 50 0. AAten. 30 dB PNO. Fast Careford Sector Pharme Of Parame Of Careford Social	Spectrum Analyzer 4 + Trequency Swept SA Ang Type. Log-Power 12 3 4 5 6 Center Frequency Trig Free Run
Align: Auto Freq Ref. Int (S) IF Gain: Low NFE: Adaptive Sig Track: Off	P N N N N N Span	Align: Auto Freq Ref. Int (S) IF Gain. Low Vol NFE: Adeptive Sig Track: Off	P NN N N N P NN N N N Span
Spectrum Ref Lvi Offset 10.00 dB Mkr6 cale/Div 10 dB Ref Level 20.00 dBm	2.489 041 75 GHz -50.14 dBm Zero Span	1 Spectrum Ref Lvt Offset 10.00 dB Scale/Div 10 dB Ref Level 20.00 dBm Log v	Mkr1 2.192 65 GHz -48.85 dBm Svept Span Zero Span
00	Full Span	10.0	Full Span
	2.310000000 GHz	.10.0	Start Freq 1.000000 MHz
00 meterselsenseteningesteringen von hannen hannen 00	Stop Freq 2.50000000 GHz	-20 0	01.1 23 11 dBm Stop Freq 2.310000000 GHz
	Stop 2.50000 GHz Sweep 2.67 ms (40001 pts) CF Step	-40.0	▲UTO TUNE CF Step 230.900000 MHz
Marker Table Mode Trace Scale X Y Function Function W	19.00000 MHz Auto Man	-50 0 Alexandria una esta participante de la constitución de la constitución de la constitución de la constitución de -60 0	230.900000 NHz Auto Man
1 N 1 f 2.440 245 00 GHz -0.6295 dBm 2 N 1 f 2.400 0000 GHz -63454 dBm 3 N 1 f 2.300 0000 GHz -54.55 dBm 4 N 1 f 2.306 914 50 GHz -41.93 dBm	Freq Offset 0 Hz	-70.0	Freq Offset 0 Hz
4 N 1 f 2.366 914 50 GHz -49.93 dBm 5 N 1 f 2.483 500 00 GHz -53.47 dBm 6 N 1 f 2.489 041 75 GHz -50.14 dBm	X Axis Scale Log Lin	Start 1 MHz #Video BW 300 kHz #Res BW 100 kHz	Sweep ~8.65 ms (40001 pts)
	Signal Track	4 5 C 1 ? Aug 13, 2020	📰 🕃 🗄 🔀 Signal Track
2440MHz,Plot 4,2500MH	z~5000MHz	2440MHz,Plot 5,5000	/Hz~25000MHz

TEST REPORT



TEST REPORT

Spectrum Analyzer 1 Swept SA	Spectrum Analyzer 2 Channel Power	Spectrum Analyzer 3 Swept SA	Spectrum Analyzer 4 Swept SA	+	Frequency	•
KEYSIGHT Input. RF R L			Trig: Free Run M W	WWWW NNNN	Center Frequency 15.000000000 GHz Span	Setti
1 Spectrum Scale/Div 10 dB Log		offset 10.00 dB I 20.00 dBm	Mkr1 23.870 (-41.37	0 GHz	20.0000000 GHz Swept Span Zero Span	
					Full Span Start Freq	
				19.02 #7=	5.000000000 GHz Stop Freq	
				<u></u>	25.000000000 GHz AUTO TUNE	
-40.0 -50.0					CF Step 2.000000000 GHz Auto	
-60.0					Man Freq Offset D Hz	
Start 5.00 GHz #Res BW 100 kHz	#Video	BW 300 kHz	Stop 25 Sweep ~68.9 ms (40	.00 GHz	(Axis Scale Log Lin	
4 h C 1	Aug 13, 2020				Signal Track Scan Zoom)	