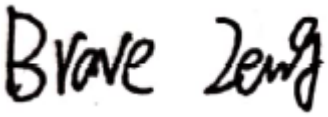
TEST REPORT

Report No.:	BCTC2206256789-7E
Applicant:	ROCKPI TRADING LIMITED
Product Name:	ROCK Pi E
Model/Type Ref.:	ROCK Pi E D8W2
Tested Date:	2022-06-30 to 2022-07-05
Issued Date:	2022-07-07

Shenzhen BCTC Testing Co., Ltd.

Product Name:	ROCK Pi E
Trademark:	N/A
Model/Type Ref.:	ROCK Pi E D8W2 ROCK Pi E D8W2P, ROCK Pi E D4W1P
Prepared For:	ROCKPI TRADING LIMITED
Address:	Room 11, 27 / f, Ga wah international centre, 191 Javaroad, north point, Hong Kong
Manufacturer:	ROCKPI TRADING LIMITED
Address:	Room 11, 27 / f, Ga wah international centre, 191 Javaroad, north point, Hong Kong
Prepared By:	Shenzhen BCTC Testing Co., Ltd.
Address:	1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China
Sample Received Date:	2022-06-30
Sample tested Date:	2022-06-30 to 2022-07-05
Issue Date:	2022-07-07
Report No.:	BCTC2206256789-7E
Test Standards	ETSI EN 300 440 V2.2.1 (2018-07)
Test Results	PASS
Remark:	This is WIFI-5.8GHz band radio test report.

Tested by:



Brave Zeng/ Project Handler

Approved by:

Zero Zhou/Reviewer

Table Of Content

(Note: N/A Means Not Applicable)

1. Version

Report No.	Issue Date	Description	Approved
BCTC2206256789-7E	2022-07-07	Original	Valid

2. Test Summary

The Product has been tested according to the following specifications:

No.	Test Parameter	Clause No	Results
Transmitter Parameters			
1	Equivalent isotropically radiated power (e.i.r.p.)	4.2.2	PASS
2	Permitted range of operating frequencies	4.2.3	PASS
3	Spurious radiation for transmitter	4.2.4	PASS
4	Duty Cycle	4.2.5.4	No Restriction
5	Additional requirements for FHSS equipment	4.2.6	N/A[1]
6	Adjacent channel selectivity	4.3.3	N/A[2]
7	Blocking or desensitization	4.3.4	PASS
8	Spurious radiation for receiver	4.3.5	PASS
9	Spectrum access techniques	4.4	N/A[3]
10	GBSAR antenna pattern	4.6.4	N/A[4]
11	Limits for GBSAR	Annex I	N/A[4]

This product is equipment Category 2 receivers
Note[1]:Applies to Equipment utilizing FHSS modulation
Note[2]:Applies to equipment Category 1 receivers
Note[3]:Applies to Equipment which are not using duty cycle restrictions for media access
Note[4]:Applies only GBSAR systems

3. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

RF frequency	1×10^{-7}
RF power, conducted	1.38dB
Conducted spurious emission (30MHz-1GHz)	1.28dB
Conducted spurious emission (1GHz-18GHz)	1.576dB
Radiated Spurious emission (30MHz-1GHz)	4.3dB
Radiated Spurious emission (1GHz-18GHz)	4.5dB
Temperature	0.59℃
Humidity	5.3%

4. Product Information And Test Setup

4.1 Product Information

Model/Type Ref.	ROCK Pi E D8W2 ROCK Pi E D8W2P, ROCK Pi E D4W1P
Model differences:	All the model are the same circuit and RF module, except model names.
Hardware Version:	N/A
Software Version:	N/A
Type of Modulation:	WIFI(5.8GHz): IEEE 802.11a/n/ac HT20:5745MHz-5825MHz IEEE 802.11n/ac HT40:5755 MHz-5795MHz IEEE 802.11ac HT80:5775MHz
Max. RF output power:	WIFI(5.8GHz): 10.08 dBm
Type of Modulation:	WIFI(5.8GHz): OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM
Antenna installation:	WIFI(5.8GHz): Internal antenna
Antenna Gain:	WIFI(5.8GHz): 2 dBi
Ratings:	DC 5V From Adapter

Cable of Product

No.	Cable Type	Quantity	Provider	Length (m)	Shielded	Note
1	--	--	Applicant	---	Yes/No	With a ferrite ring in mid Detachable
2	--	--	BCTC	--	Yes/No	--

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note
1.	Adapter	UGREEN	CD122	---	---

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)
149	5745	151	5755	153	5765	157	5785
159	5795	161	5805	165	5825		

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting(802.11a)	5745MHz	5785MHz	5825MHz
Transmitting(802.11n HT20)	5745MHz	5785MHz	5825MHz
Transmitting(802.11n HT40)	5755Mhz	/	5795MHz
Transmitting(802.11ac HT20)	5745MHz	5785MHz	5825MHz
Transmitting(802.11ac HT40)	5755Mhz	/	5795MHz
Transmitting(802.11ac HT80)	/	5775MHz	/
Receiving(802.11a)	5745MHz	5785MHz	5825MHz
Receiving(802.11n HT20)	5745MHz	5785MHz	5825MHz
Receiving(802.11n HT40)	5755Mhz	/	5795MHz
Receiving(802.11ac HT20)	5745MHz	5785MHz	5825MHz
Receiving(802.11ac HT40)	5755Mhz	/	5795MHz
Receiving(802.11ac HT80)	/	5775MHz	/

4.6 Test Environment

1. Normal Test Conditions:

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Temperature(℃):	26
Test Voltage(DC):	5V

2.Extreme Test Conditions:

For tests at extreme temperatures, measurements shall be made over the extremes of the operating temperature range as declared by the manufacturer.

For tests at extreme voltages, measurements shall be made over the extremes of the power source voltage range as declared by the manufacturer.

Test Conditions	**LTLV**	**LTHV**	**HTHV**	**HTLV**
Temperature (℃)	0	0	45	45
Test Voltage (DC)	4.5	5.5	4.5	5.5

5. Test Facility And Test Instrument Used

5.1 Test Facility

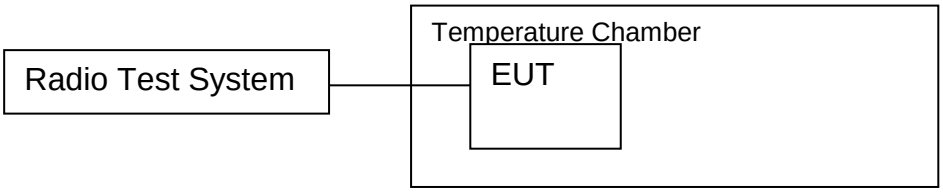
All measurement facilities used to collect the measurement data are located at 1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	966 chamber	ChengYu	966 Room	966	Jun. 06. 2020	Jun. 05, 2023
2	Receiver	R&S	ESR3	102075	May 24, 2022	May 23, 2023
3	Spectrum Analyzer	Agilent	E4407B	MY45109572	May 24, 2022	May 23, 2023
4	Amplifier	SKET	LAPA_01G18G-45dB	\	May 24, 2022	May 23, 2023
5	Amplifier	Schwarzbeck	BBV9744	9744-0037	May 24, 2022	May 23, 2023
6	TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	942	May 26, 2022	May 25, 2023
7	Horn Antenna	Schwarzbeck	BBHA9120D	1541	May 24, 2022	May 23, 2023
8	band rejection filter	ZBSF	ZBSF-C2441.5	1706003606	May 24, 2022	May 23, 2023
9	Signal Generator	Keysight	N5181A	MY50143748	May 24, 2022	May 23, 2023
10	Communication test set	R&S	CMU200	119435	May 24, 2022	May 23, 2023
11	Spectrum Analyzer	Keysight	N9020A	MY49100060	May 24, 2022	May 23, 2023
12	Signal Generator	Keysight	N5182B	MY56200519	May 24, 2022	May 23, 2023
13	Power Meter	Keysight	E4419	\	May 24, 2022	May 23, 2023
14	Power Sensor	Keysight	E9300A	\	May 24, 2022	May 23, 2023
15	Horn antenna	Schwarzbeck	BBHA9170	00822	May 24, 2022	May 23, 2023
16	Preamplifier	MITEQ	TTA1840-35-HG	2034381	May 24, 2022	May 23, 2023
17	Software	Frad	EZ-EMC	FA-03A2 RE	\	\
18	Software	Keysight	Keysight.ETS LTest system	1.02.05	\	\
19	D.C. Power Supply	LongWei	TPR-6405D	\	\	\
20	Loop Antenna	Schwarzbeck	FMZB1519B	00014	May 24, 2022	May 23, 2023
21	Communication test set	Agilent	N4010A	MY49081107	May 24, 2022	May 23, 2023
22	Programmable constant temperature and humidity test chamber	DGBELL	BTKS5-150C	\	May 24, 2022	May 23, 2023

6. Equivalent Isotropically Radiated Power (E.I.R.P.)

6.1 Block Diagram Of Test Setup



6.2 Limit

25mW(14dBm)

6.3 Test Procedure

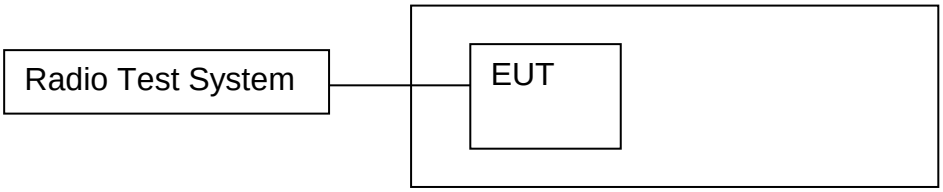
Step 1:
• using a suitable means, the output of the transmitter shall be coupled to a matched diode detector;
• the output of the diode detector shall be connected to the vertical channel of an oscilloscope;
• the combination of the diode detector and the oscilloscope shall be capable of faithfully reproducing the envelope peaks and the duty cycle of the transmitter output signal;
• the observed duty cycle of the transmitter (Tx on/(Tx on + Tx off)) shall be noted as x, (0 < x < 1) and recorded.
Step 2:
• the average output power of the transmitter shall be determined using a wideband, calibrated RF power meter with a matched thermocouple detector or an equivalent thereof and, where applicable, with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
• the e.i.r.p. shall be calculated from the above measured power output A, the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:
- P = A + G + 10 log (1/x);

6.4 Test Result

Modulation	Test conditions (Temperature)	Low Channel	Middle Channel	High Channel
		EIRP	EIRP	EIRP
802.11a	Normal	**10.08**	9.45	8.77
	Lower	9.73	8.99	7.92
	Upper	8.92	8.69	7.57
802.11n(HT20)	Normal	9.37	8.71	8.02
	Lower	8.47	8.05	7.20
	Upper	8.25	7.20	6.23
802.11n(HT40)	Normal	8.34	/	7.85
	Lower	7.97	/	7.78
	Upper	7.81	/	7.25
802.11ac(HT20)	Normal	9.03	8.27	7.85
	Lower	8.06	8.04	7.37
	Upper	8.05	7.13	6.71
802.11ac(HT40)	Normal	8.06	/	7.34
	Lower	7.44	/	7.24
	Upper	6.60	/	6.30
802.11ac(HT80)	Normal	/	7.57	/
	Lower	/	6.72	/
	Upper	/	6.67	/
Limit		≤25mW (14dBm)		
Remark: P = A + G + Y,G=2 dBi, x=100%				

7. Permitted Range Of Operating Frequencies

7.1 Block Diagram Of Test Setup



7.2 Limit

5725 MHz to 5875 MHz

7.3 Test Procedure

a) put the spectrum analyser in video averaging mode with a minimum of 50 sweeps selected;
b) select the lowest operating frequency of the equipment under test and activate the transmitter with modulation applied. The RF emission of the equipment shall be displayed on the spectrum analyser;
c) using the marker of the spectrum analyser, find the lowest frequency below the operating frequency at which the spectral power density drops below the level given in clause 4.2.3. This frequency shall be recorded in the test report;
d) select the highest operating frequency of the equipment under test and find the highest frequency at which the spectral power density drops below the value given in clause 4.2.3. This frequency shall be recorded in the test report;
e) the difference between the frequencies measured in steps c) and d) is the operating frequency range. It shall be recorded in the test report.

7.4 Test Result

802.11 a

Test Conditions	Frequencies (MHz) at -30dBm/30kHz (EIRP)		Occupied Channel (MHz)
	Lowest Frequency (fL)	Highest Frequency (fH)	
Normal	5736.56	/	16.669
	/	5833.24	16.648
LTLV	5736.36	/	16.492
	/	5832.88	16.446
LTHV	5736.20	/	16.209
	/	5832.25	16.350
HTHV	5735.94	/	16.044
	/	5831.85	16.218
HTLV	5735.28	/	15.913
	/	5831.70	16.139

802.11 n20

Test Conditions	Frequencies (MHz) at -30dBm/30kHz (EIRP)		Occupied Channel (MHz)
	Lowest Frequency (fL)	Highest Frequency (fH)	
Normal	5736.12	/	17.739
	/	5833.76	17.725
LTLV	5735.24	/	17.451
	/	5833.08	17.500
LTHV	5734.77	/	17.201
	/	5832.21	17.313
HTHV	5734.48	/	16.970
	/	5831.65	17.109
HTLV	5733.92	/	16.948
	/	5831.22	16.940

802.11 ac20

Test Conditions	Frequencies (MHz) at -30dBm/30kHz (EIRP)		Occupied Channel (MHz)
	Lowest Frequency (fL)	Highest Frequency (fH)	
Normal	5736.08	/	17.753
	/	5833.88	17.735
LTLV	5735.18	/	17.511
	/	5833.31	17.696
LTHV	5734.43	/	17.276
	/	5832.47	17.482
HTHV	5733.52	/	17.251
	/	5832.35	17.338
HTLV	5733.46	/	17.233
	/	5831.72	17.040

802.11 n40

Test Conditions	Frequencies (MHz) at -30dBm/30kHz (EIRP)		Occupied Channel (MHz)
	Lowest Frequency (fL)	Highest Frequency (fH)	
Normal	5736.58	/	36.647
	/	5813.40	36.656
LTLV	5736.46	/	36.575
	/	5813.26	36.538
LTHV	5736.37	/	36.345
	/	5813.04	36.291
HTHV	5735.28	/	36.185
	/	5812.98	36.092
HTLV	5734.99	/	35.972
	/	5812.77	35.895

802.11 ac40

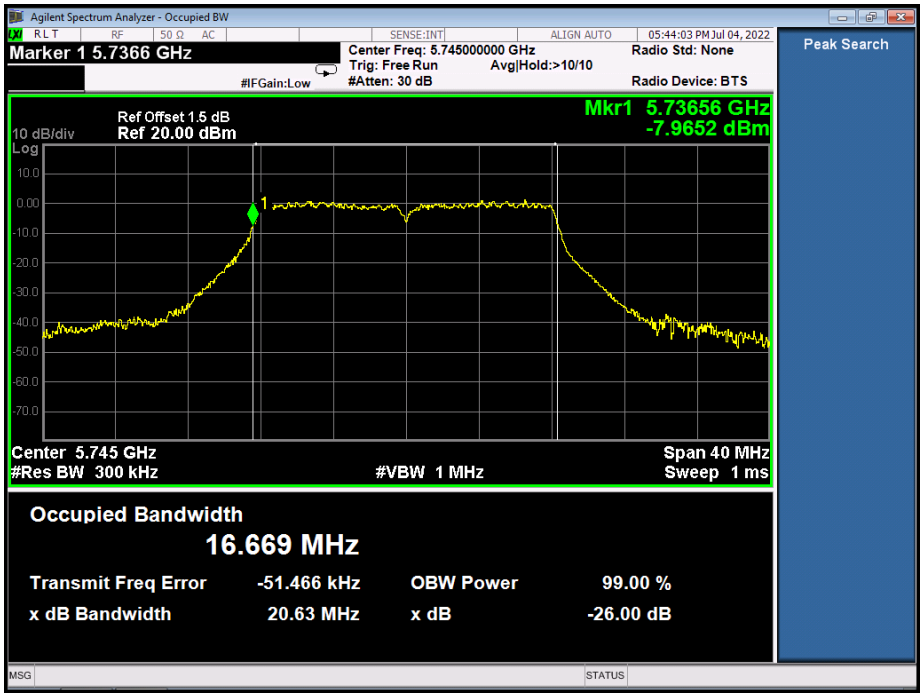
Test Conditions	Frequencies (MHz) at -30dBm/30kHz (EIRP)		Occupied Channel (MHz)
	Lowest Frequency (fL)	Highest Frequency (fH)	
Normal	5736.88	/	36.440
	/	5813.18	36.500
LTLV	5736.77	/	36.262
	/	5812.90	36.410
LTHV	5736.67	/	36.026
	/	5812.17	36.189
HTHV	5735.96	/	35.839
	/	5811.27	36.123
HTLV	5735.22	/	35.606
	/	5810.58	36.090

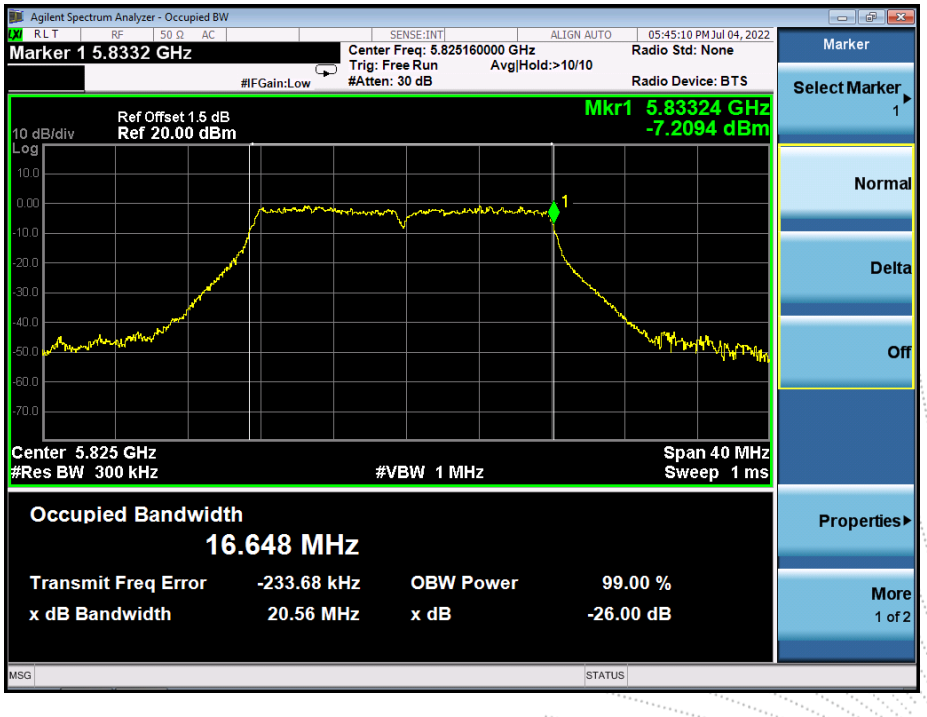
802.11 ac80

Test Conditions	Frequencies (MHz) at -30dBm/30kHz (EIRP)		Occupied Channel (MHz)
	Lowest Frequency (fL)	Highest Frequency (fH)	
Normal	5737.20	/	75.624
	/	5812.92	75.604
LTLV	5736.75	/	75.503
	/	5812.46	75.458
LTHV	5736.18	/	75.228
	/	5811.88	75.169
HTHV	5735.69	/	75.142
	/	5811.83	75.155
HTLV	5734.94	/	74.860
	/	5811.32	74.985

Test plots:

802.11 a





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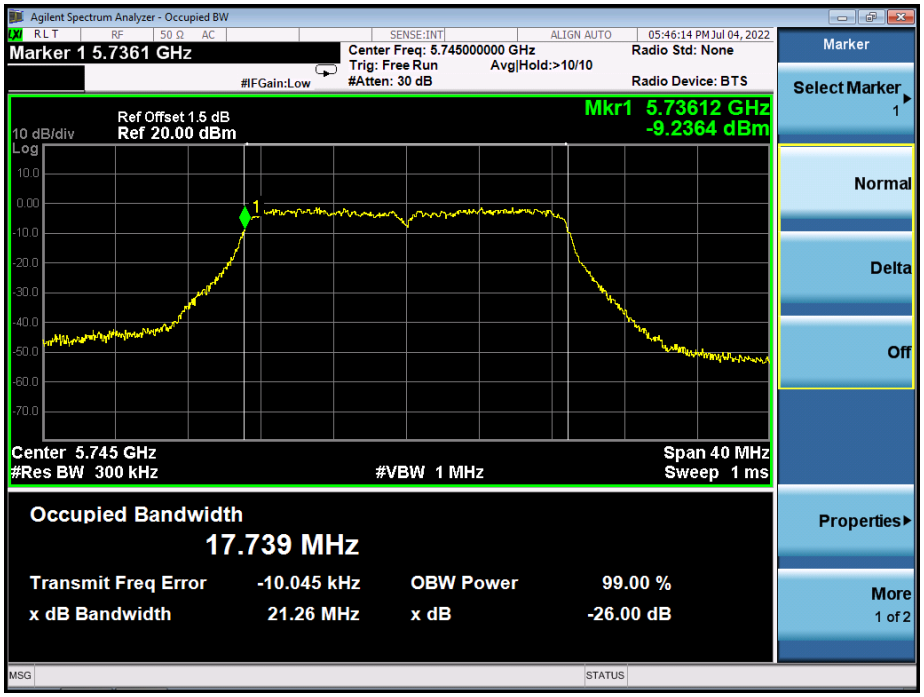
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RF
50 Ω AC
SENSE:INT
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Marker 1 5.7361 GHz
Center Freq: 5.745000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.73612 GHz
-9.2364 dBm
Center 5.745 GHz
#Res BW 300 kHz
#VBW 1 MHz
Span 40 MHz
Sweep 1 ms
Occupied Bandwidth
17.739 MHz
Transmit Freq Error -10.045 kHz
OBW Power 99.00 %
x dB Bandwidth 21.26 MHz
x dB -26.00 dB
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Select Marker
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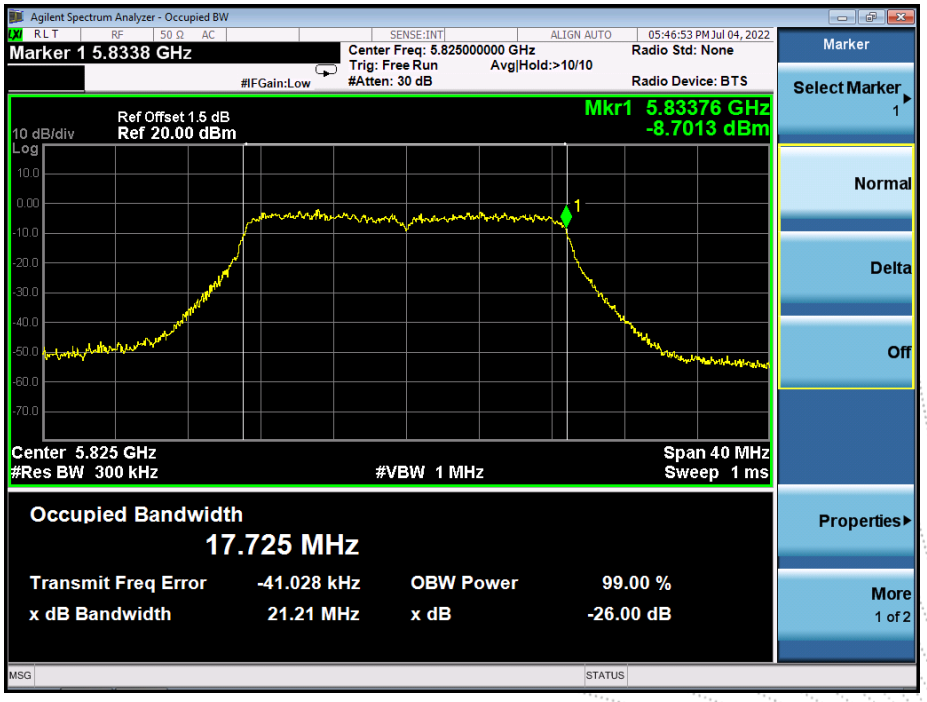
Delta
Off
Properties
More
1 of 2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RF
50 Ω AC
SENSE:INT
ALIGN AUTO
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Marker 1 5.8338 GHz
Center Freq: 5.825000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.83376 GHz
-8.7013 dBm
Center 5.825 GHz
#Res BW 300 kHz
#VBW 1 MHz
Span 40 MHz
Sweep 1 ms
Occupied Bandwidth
17.725 MHz
Transmit Freq Error -41.028 kHz
OBW Power 99.00 %
x dB Bandwidth 21.21 MHz
x dB -26.00 dB
MSG
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Marker
Select Marker
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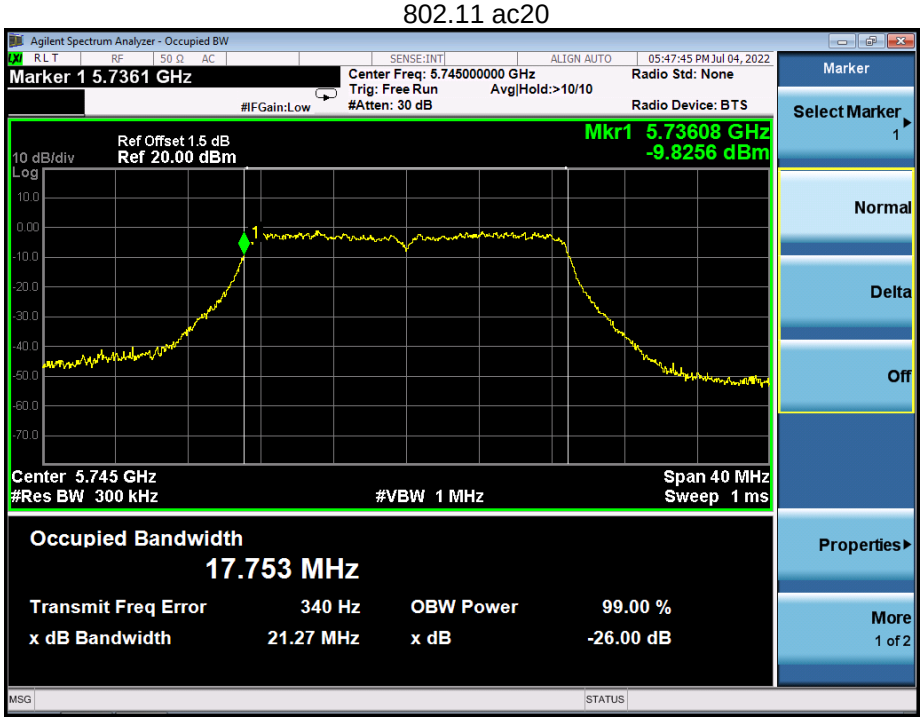
Delta
Off
Properties
More
1 of 2

802.11 ac20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RF
50 Ω AC
SENSE:INT
ALIGN AUTO
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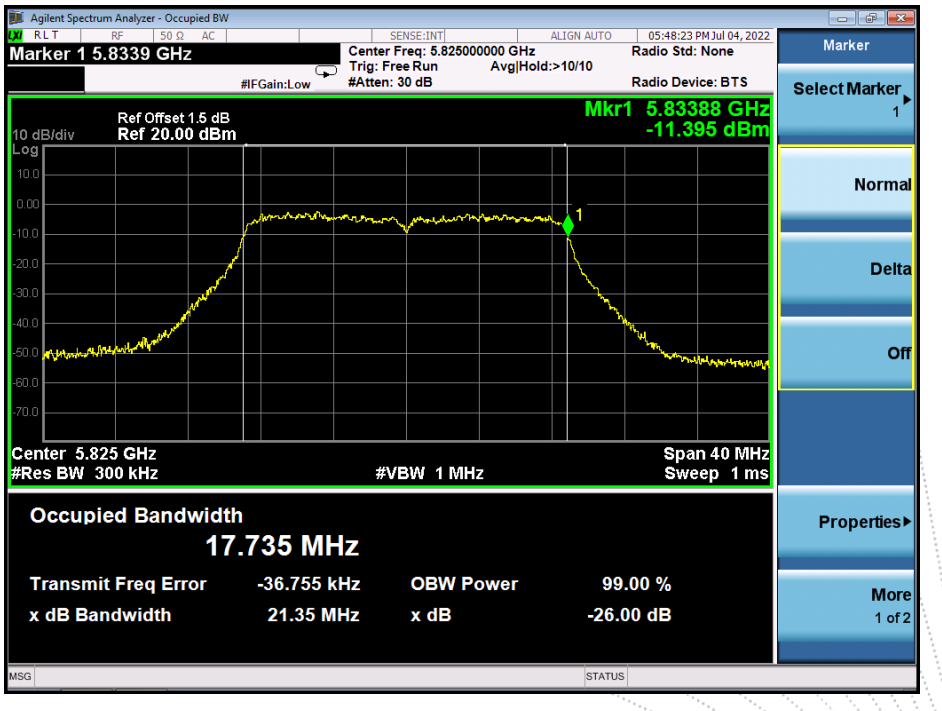
Marker 1 5.7361 GHz
#IFGain:Low
Center Freq: 5.745000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.73608 GHz
-9.8256 dBm
Center 5.745 GHz
#Res BW 300 kHz
#VBW 1 MHz
Span 40 MHz
Sweep 1 ms
Occupied Bandwidth
17.753 MHz
Transmit Freq Error 340 Hz
OBW Power 99.00 %
x dB Bandwidth 21.27 MHz
x dB -26.00 dB
MSG
STATUS
Marker
Select Marker
1
Normal
Delta
Off
Properties
More
1 of 2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RF
50 Ω AC
SENSE:INT
ALIGN AUTO
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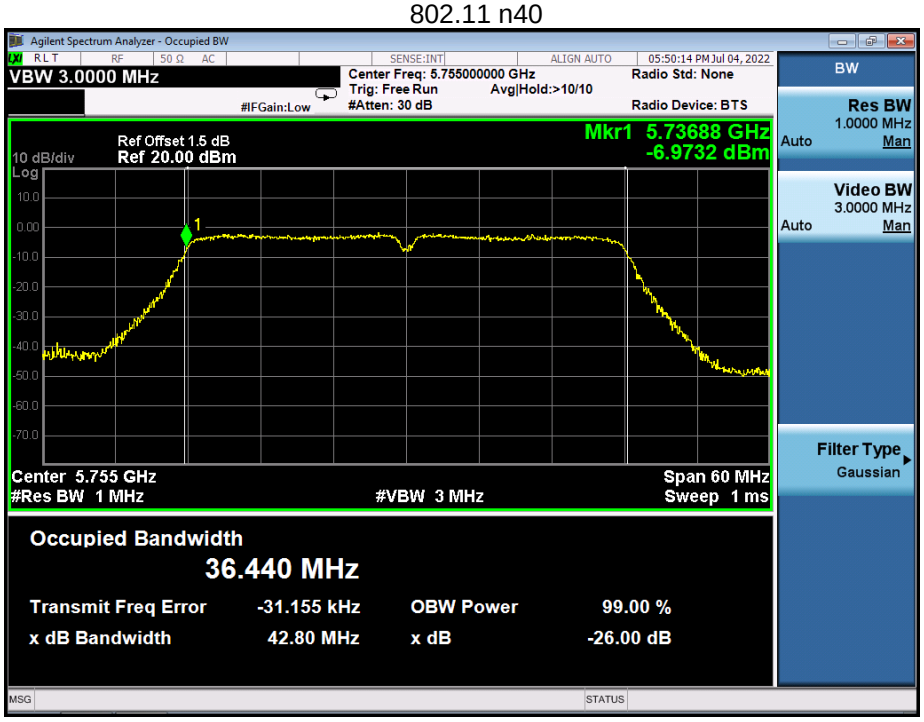
Marker 1 5.8339 GHz
#IFGain:Low
Center Freq: 5.825000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.83388 GHz
-11.395 dBm
Center 5.825 GHz
#Res BW 300 kHz
#VBW 1 MHz
Span 40 MHz
Sweep 1 ms
Occupied Bandwidth
17.735 MHz
Transmit Freq Error -36.755 kHz
OBW Power 99.00 %
x dB Bandwidth 21.35 MHz
x dB -26.00 dB
MSG
STATUS
Marker
Select Marker
1
Normal
Delta
Off
Properties
More
1 of 2

802.11 n40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RF
50 Ω AC
SENSE:INT
ALIGN AUTO
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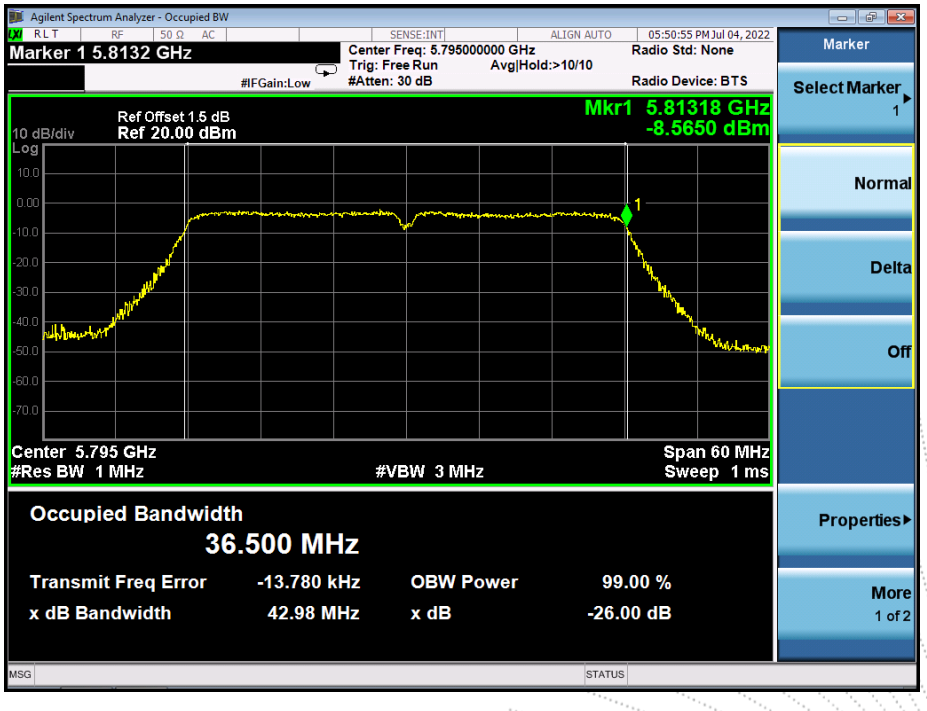
VBW 3.0000 MHz
#IFGain:Low
Center Freq: 5.755000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.73688 GHz
-6.9732 dBm
Center 5.755 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Occupied Bandwidth
36.440 MHz
Transmit Freq Error -31.155 kHz
OBW Power 99.00 %
x dB Bandwidth 42.80 MHz
x dB -26.00 dB
MSG
STATUS
BW
Res BW
1.0000 MHz
Auto Man
Video BW
3.0000 MHz
Auto Man
Filter Type
Gaussian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50 Ω AC
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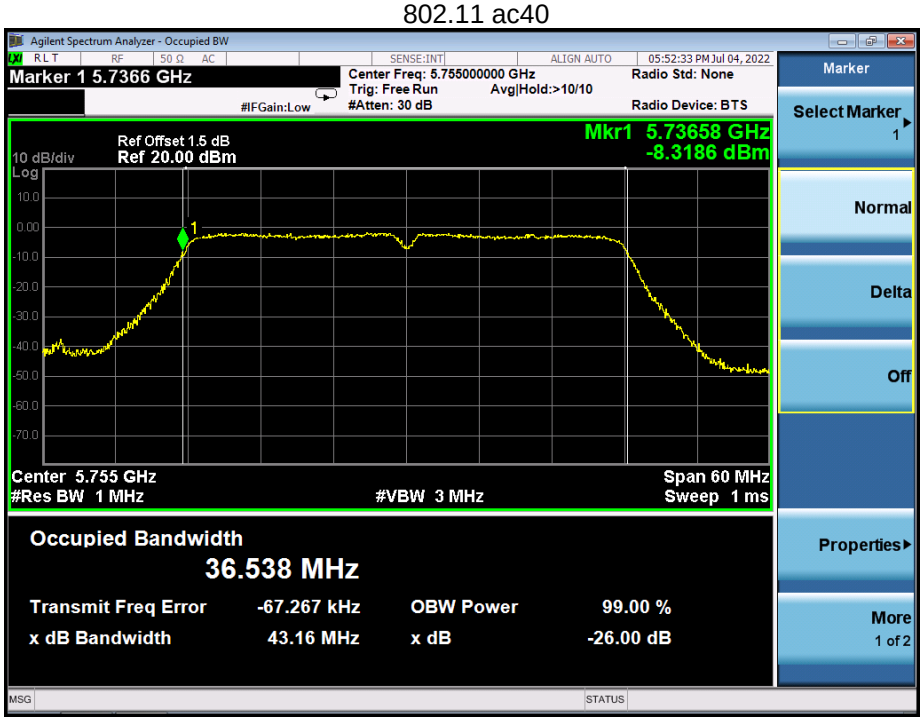
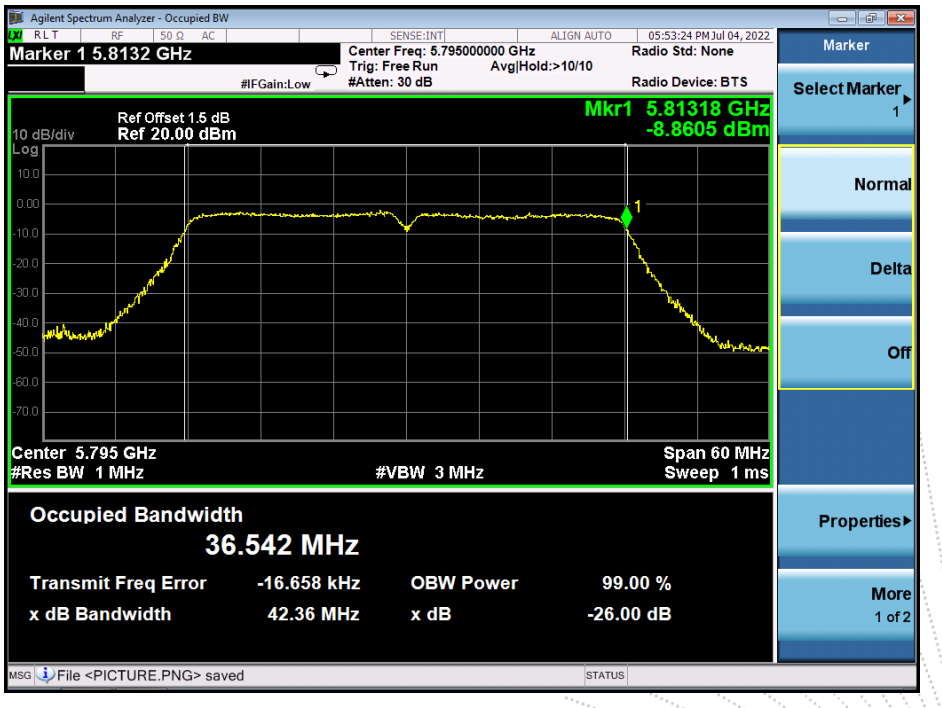
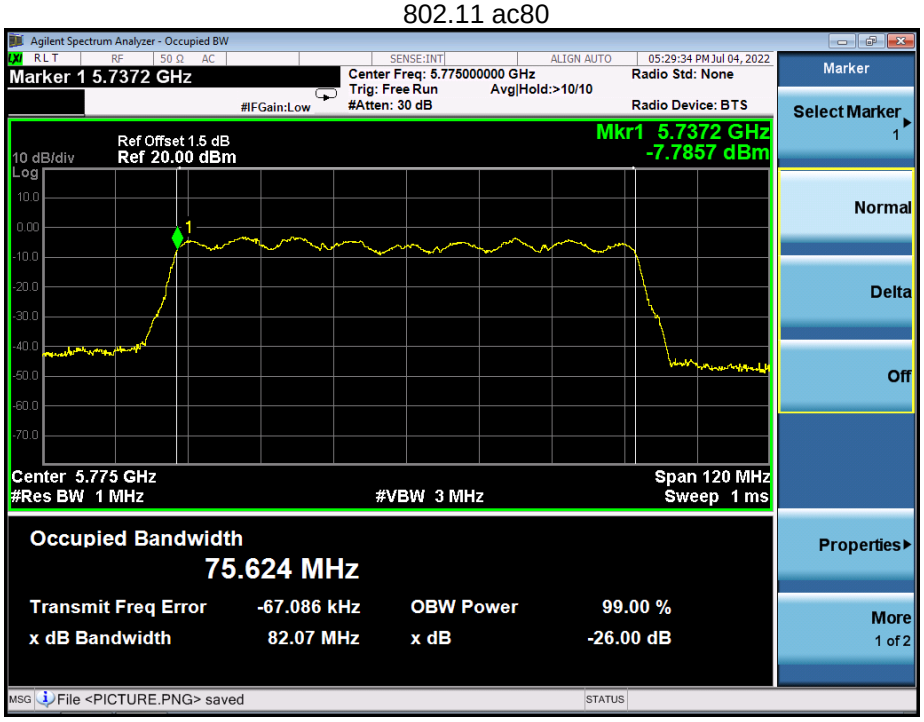
Marker 1 5.8132 GHz
#IFGain:Low
Center Freq: 5.795000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.81318 GHz
-8.5650 dBm
Center 5.795 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Occupied Bandwidth
36.500 MHz
Transmit Freq Error -13.780 kHz
OBW Power 99.00 %
x dB Bandwidth 42.98 MHz
x dB -26.00 dB
MSG
STATUS
Marker
Select Marker
1
Normal
Delta
Off
Properties
More
1 of 2

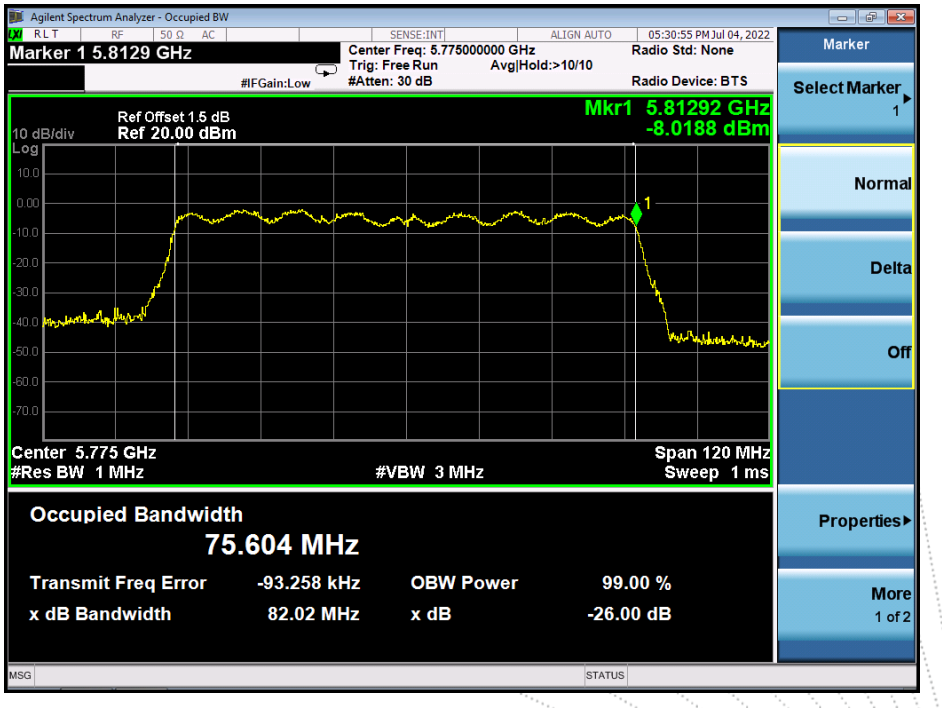
802.11 ac40


Agilent Spectrum Analyzer - Occupied BW
RLT
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
05:52:33 PM Jul 04, 2022
Marker 1 5.7366 GHz
#IFGain:Low
Center Freq: 5.755000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.73658 GHz
-8.3186 dBm
Center 5.755 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Occupied Bandwidth
36.538 MHz
Transmit Freq Error -67.267 kHz
OBW Power 99.00 %
x dB Bandwidth 43.16 MHz
x dB -26.00 dB
Marker
Select Marker
1
Normal
Delta
Off
Properties
More
1 of 2
MSG
STATUS


Agilent Spectrum Analyzer - Occupied BW
RLT
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
05:53:24 PM Jul 04, 2022
Marker 1 5.8132 GHz
#IFGain:Low
Center Freq: 5.795000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.81318 GHz
-8.8605 dBm
Center 5.795 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Occupied Bandwidth
36.542 MHz
Transmit Freq Error -16.658 kHz
OBW Power 99.00 %
x dB Bandwidth 42.36 MHz
x dB -26.00 dB
Marker
Select Marker
1
Normal
Delta
Off
Properties
More
1 of 2
MSG
File <PICTURE.PNG> saved
STATUS

802.11 ac80

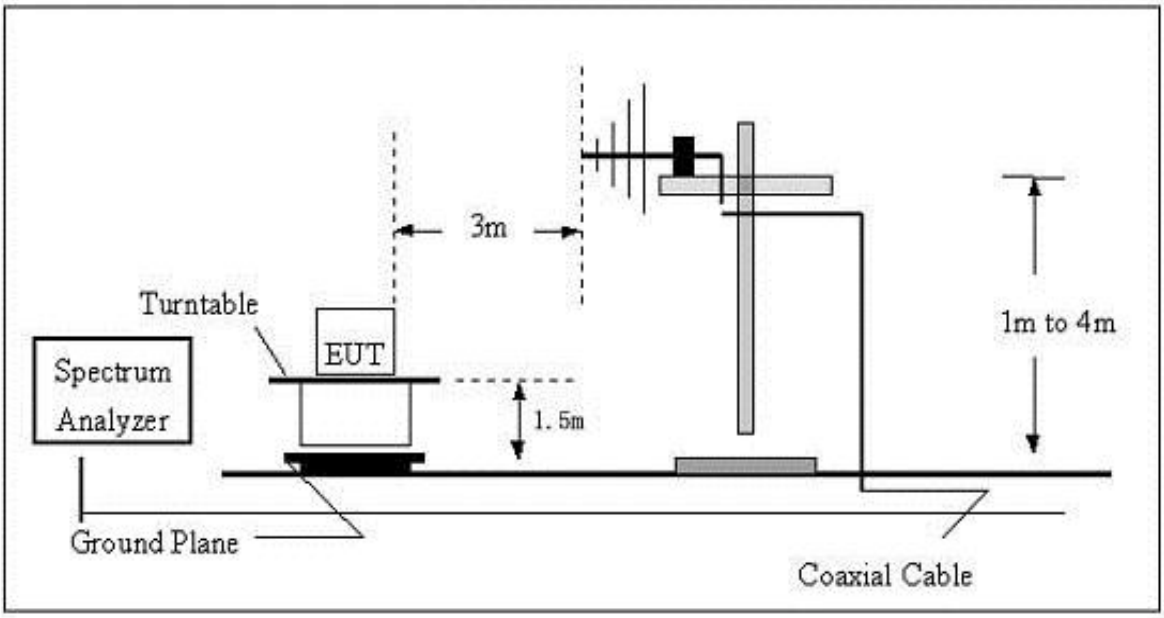

Agilent Spectrum Analyzer - Occupied BW
RLT
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
05:29:34 PM Jul 04, 2022
Marker 1 5.7372 GHz
#IFGain:Low
Center Freq: 5.775000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.7372 GHz
-7.7857 dBm
Center 5.775 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 120 MHz
Sweep 1 ms
Occupied Bandwidth
75.624 MHz
Transmit Freq Error
-67.086 kHz
OBW Power
99.00 %
x dB Bandwidth
82.07 MHz
x dB
-26.00 dB
File <PICTURE.PNG> saved
MSG
STATUS
Marker
Select Marker
1
Normal
Delta
Off
Properties
More
1 of 2


Agilent Spectrum Analyzer - Occupied BW
RLT
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
05:30:55 PM Jul 04, 2022
Marker 1 5.8129 GHz
#IFGain:Low
Center Freq: 5.775000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1.5 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 5.81292 GHz
-8.0188 dBm
Center 5.775 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 120 MHz
Sweep 1 ms
Occupied Bandwidth
75.604 MHz
Transmit Freq Error
-93.258 kHz
OBW Power
99.00 %
x dB Bandwidth
82.02 MHz
x dB
-26.00 dB
MSG
STATUS
Marker
Select Marker
1
Normal
Delta
Off
Properties
More
1 of 2

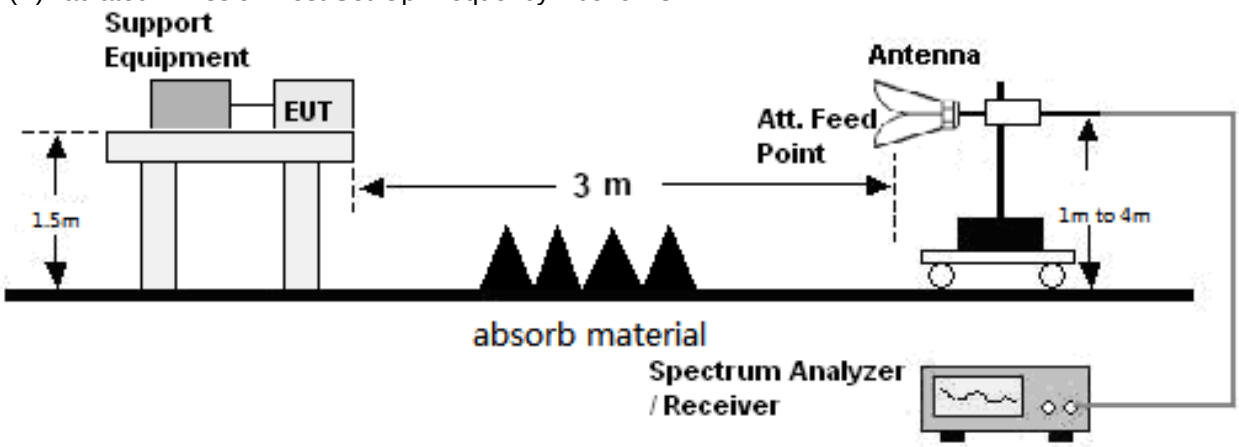
8. Spurious Emissions For Transmitter

8.1 Block Diagram Of Test Setup

(A)Radiated Emission Test Set-Up Frequency Below 1GHz.



(B)Radiated Emission Test Set-Up Frequency Above 1GHz.



8.2 Limits

Table 3: Spurious emissions

Frequency ranges / State	47 MHz to 74 MHz 87,5 MHz to 108 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1 000 MHz	Frequencies > 1 000 MHz
Operating	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

8.3 Test Procedure

30MHz ~ 1GHz:
a. The Product was placed on the nonconductive turntable 1.5m above the ground in a full anechoic chamber.
b. Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
c. For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.
Above 1GHz:
a. The Product was placed on the non-conductive turntable 1.5 m above the ground in a full anechoic chamber..
b. Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
c. For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

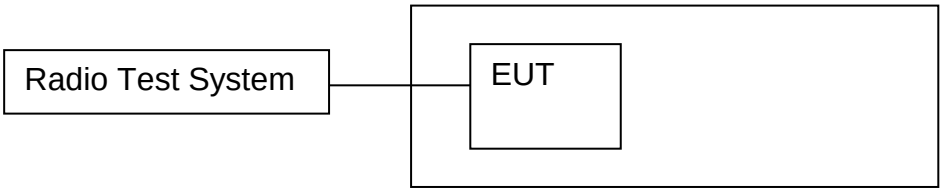
8.4 Test Results

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Correct	Absolute Level	Result	
			Height	Polar	Factor		Limit	Margin
(MHz)	(dBm)	Degree	(m)	(H/V)	(dBm)	(dBm)	(dBm)	(dB)
802.11a low channel								
530.69	-50.99	183	1.1	H	-8.17	-59.16	-54	-5.16
530.69	-52.49	38	1.8	V	-8.17	-60.65	-54	-6.65
11490.00	-39.65	2	1.3	H	-0.43	-40.08	-30	-10.08
11490.00	-41.38	113	1.4	V	-0.43	-41.81	-30	-11.81
17235.00	-60.38	89	1.7	H	8.31	-52.07	-30	-22.07
17235.00	-61.96	309	1.9	V	8.31	-53.65	-30	-23.65
802.11a Mid channel								
530.69	-51.47	112	1.0	H	-8.17	-59.64	-54	-5.64
530.69	-53.07	301	1.6	V	-8.17	-61.24	-54	-7.24
11570.00	-40.02	327	1.7	H	-0.38	-40.40	-30	-10.40
11570.00	-40.91	96	1.6	V	-0.38	-41.29	-30	-11.29
17355.00	-61.03	16	1.4	H	8.83	-52.20	-30	-22.20
17355.00	-62.47	86	1.4	V	8.83	-53.64	-30	-23.64
802.11a high channel								
530.69	-51.53	101	1.1	H	-8.17	-59.70	-54	-5.70
530.69	-52.98	126	2.0	V	-8.17	-61.15	-54	-7.15
11650.00	-39.02	139	1.7	H	-0.32	-39.34	-30	-9.34
11650.00	-41.40	300	1.9	V	-0.32	-41.72	-30	-11.72
17475.00	-59.61	10	1.3	H	9.35	-50.26	-30	-20.26
17475.00	-62.67	245	1.1	V	9.35	-53.32	-30	-23.32

Remark:
Absolute Level = Receiver Reading + Factor
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

9. TX Duty Cycle

9.1 Block Diagram Of Test Setup



9.2 Limit

No Restriction

9.3 Test Procedure

An assessment of the overall Duty Cycle shall be made for a representative period of Tobs over the observation bandwidth Fobs. Unless otherwise specified, Tobs is 1 hour and the observation bandwidth Fobs is the operational frequency band.
The representative period shall be the most active one in normal use of the device. As a guide "Normal use" is considered as representing the behaviour of the device during transmission of 99 % of the [emissions] generated during its operational lifetime.
Procedures such setup, commissioning, and maintenance are not considered part of normal operation.
For manual operated or event dependant devices, with or without software controlled functions, the manufacturer shall declare whether the device once triggered, follows a pre-programmed cycle, or whether the transmitter remains on until the trigger is released or the device is manually reset. The manufacturer shall also give a description of the application
for the device and include a typical usage pattern. The typical usage pattern as declared by the manufacturer shall be used to determine the duty cycle and compare to the limit in table 4.
Where an acknowledgement is required, the additional transmitter on-time shall be included and declared by the manufacturer.

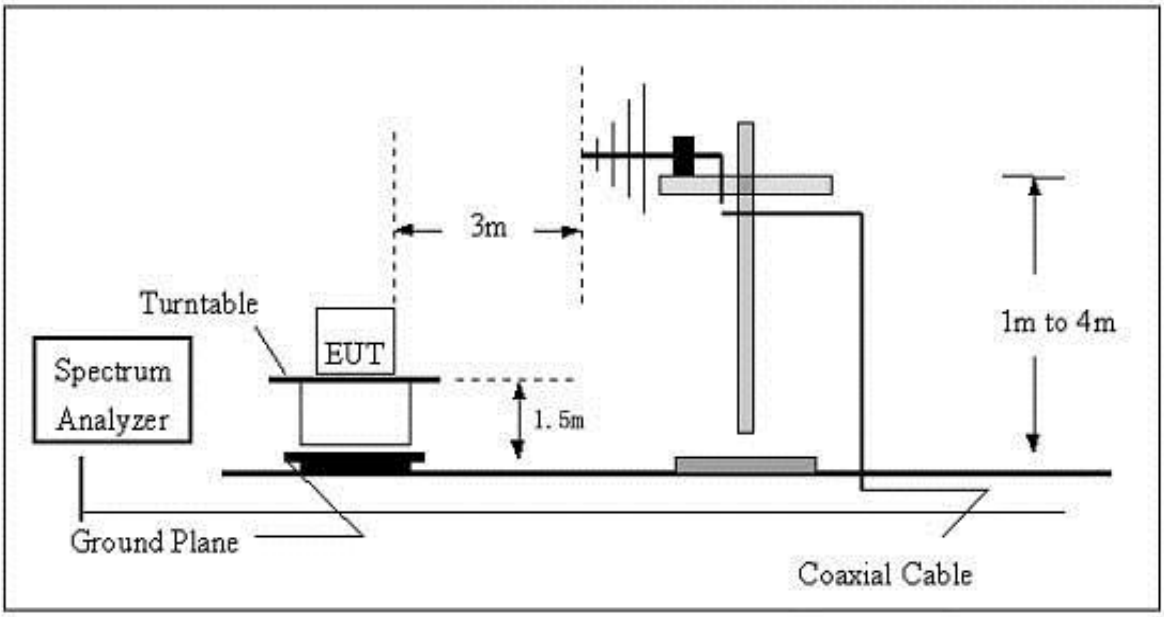
9.4 Test Result

For generic use devices operating at frequency range 5725-5875MHz, according to ETSI EN 300 440 V2.2.1 (2018-07), the duty cycle is no restriction.

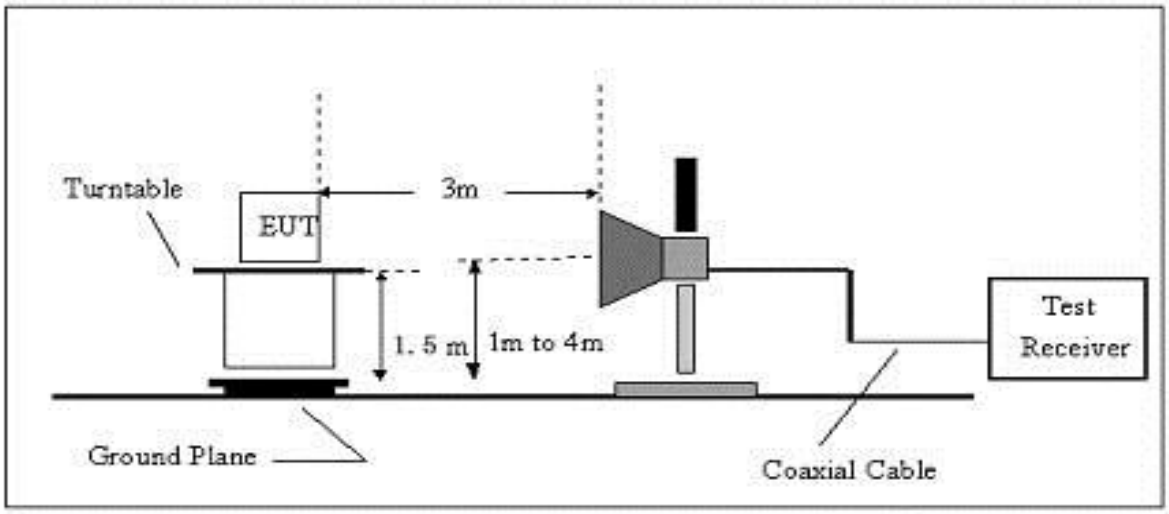
10. Spurious Emissions For Receiver

10.1 Block Diagram Of Test Setup

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



10.2 Limits

According to the Final draft ETSI EN 300 440 V2.2.1 (2018-05) Section 4.3.5.4, the power of any spurious emission shall not exceed 2 nW in the range 25 MHz to 1 GHz and shall not exceed 20 nW on frequencies above 1 GHz.

10.3 Test Procedure

30MHz ~ 1GHz:
a. The Product was placed on the nonconductive turntable 1.5m above the ground in a full anechoic chamber.
b. Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
c. For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.
Above 1GHz:
a. The Product was placed on the non-conductive turntable 1.5 m above the ground in a full anechoic chamber..
b. Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
c. For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

10.4 Test Results

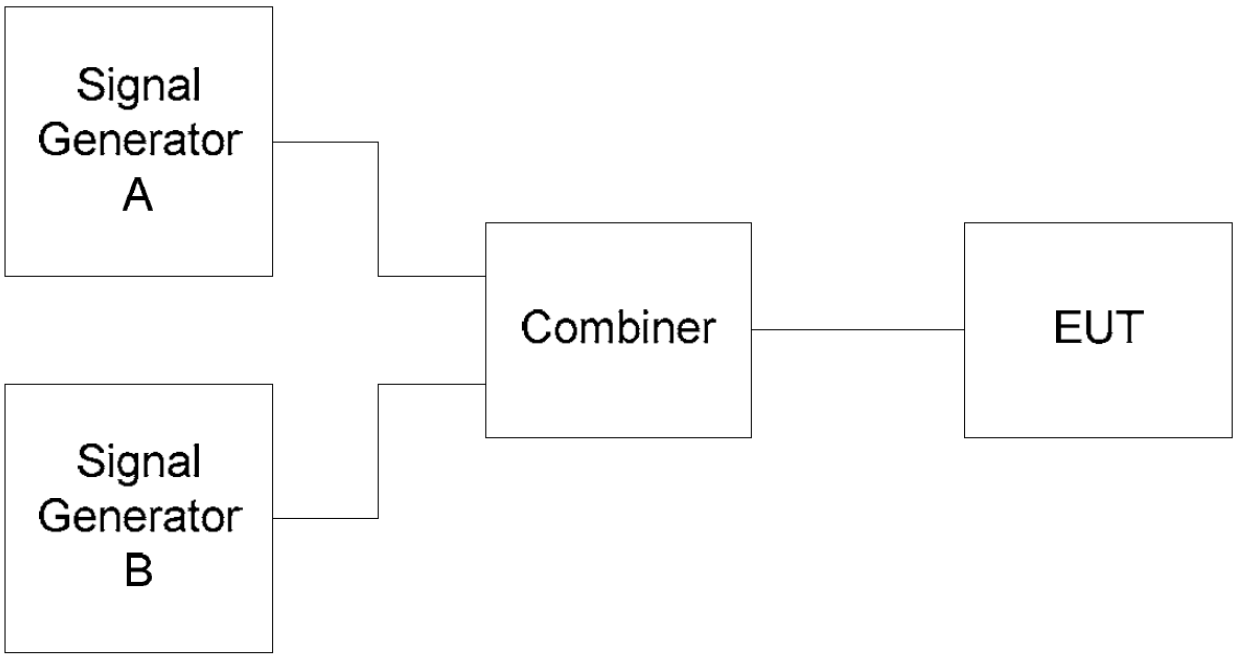
All modes have been tested and reports show data in the worst mode

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Correct	Absolute Level	Result	
			Height	Polar	Factor		Limit	Margin
(MHz)	(dBm)	Degree	(m)	(H/V)	(dBm)	(dBm)	(dBm)	(dB)
802.11a low channel								
376.91	-52.61	83	1.2	H	-11.61	-64.21	-57.00	-7.21
376.91	-52.89	31	1.3	V	-11.61	-64.49	-57.00	-7.49
2490.80	-51.08	197	1.5	H	-4.06	-55.15	-47.00	-8.15
2490.80	-54.99	177	1.3	V	-4.06	-59.05	-47.00	-12.05
802.11a HT20 Mid channel								
376.91	-52.91	129	1.7	H	-11.61	-64.51	-57.00	-7.51
376.91	-53.31	175	1.1	V	-11.61	-64.92	-57.00	-7.92
2490.80	-50.57	88	1.3	H	-4.06	-54.63	-47.00	-7.63
2490.80	-55.20	222	1.0	V	-4.06	-59.27	-47.00	-12.27
802.11a high channel								
376.91	-53.39	11	1.8	H	-11.61	-65.00	-57.00	-8.00
376.91	-52.15	338	1.9	V	-11.61	-63.76	-57.00	-6.76
2490.80	-51.69	162	1.9	H	-4.06	-55.75	-47.00	-8.75
2490.80	-54.34	14	1.1	V	-4.06	-58.40	-47.00	-11.40

Remark:
Absolute Level = Receiver Reading + Factor
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

11. Blocking Or Desensitization

11.1 Block Diagram Of Test Setup



11.2 Limit

The adjacent channel selectivity of the equipment under specified conditions shall not be less than -30 dBm + k. The correction factor, k, is as follows:

Table 6: Limits for blocking or desensitization

Receiver category	Limit
1	-30 dBm + k
2	-45 dBm + k
3	-60 dBm + k

The correction factor, k, is as follows:

$$k = -20\log f - 10\log BW$$

Where:
-f is the frequency in GHz;
-BW is the occupied bandwidth in MHz.
The factor k is limited within the following:

- -40 dB < k < 0 dB.

The measured blocking level shall be stated in the test report.

11.3 Test Procedure

This measurement shall be conducted under normal conditions.
Two signal generators A and B shall be connected to the receiver via a combining network to the receiver, either:

a) via a test fixture or a test antenna to the receiver integrated, dedicated or test antenna; or
b) directly to the receiver permanent or temporary antenna connector.

The method of coupling to the receiver shall be stated in the test report.
Signal generator A shall be at the nominal frequency of the receiver, with normal modulation of the wanted signal. Signal generator B shall be unmodulated and shall be adjusted to a test frequency at approximately 10 times, 20 times and 50 times of the occupied bandwidth above upper band edge of occupied bandwidth. Initially signal generator B shall be switched off and using signal generator A the level which still gives sufficient response shall be established. The output level of generator A shall then be increased by 3 dB. Signal generator B is then switched on and adjusted until the wanted criteria are met. This level shall be recorded.
The measurement shall be repeated with the test frequency for signal generator B at 10 times, 20 times and 50 times of the occupied bandwidth below the lower band edge of the occupied bandwidth.
The blocking or desensitization shall be recorded as the level in dBm of lowest level of the unwanted signal (generator B).
For tagging systems (e.g. RF identification, anti-theft, access control, location and similar systems) signal generator A may be replaced by a physical tag positioned at 70 % of the measured system range in metres. In this case, the blocking or desensitization shall be recorded as the ratio in dB of lowest level of the unwanted signal (generator B) resulting in a non-read of the tag. to the declared sensitivity of the receiver +3 dB.

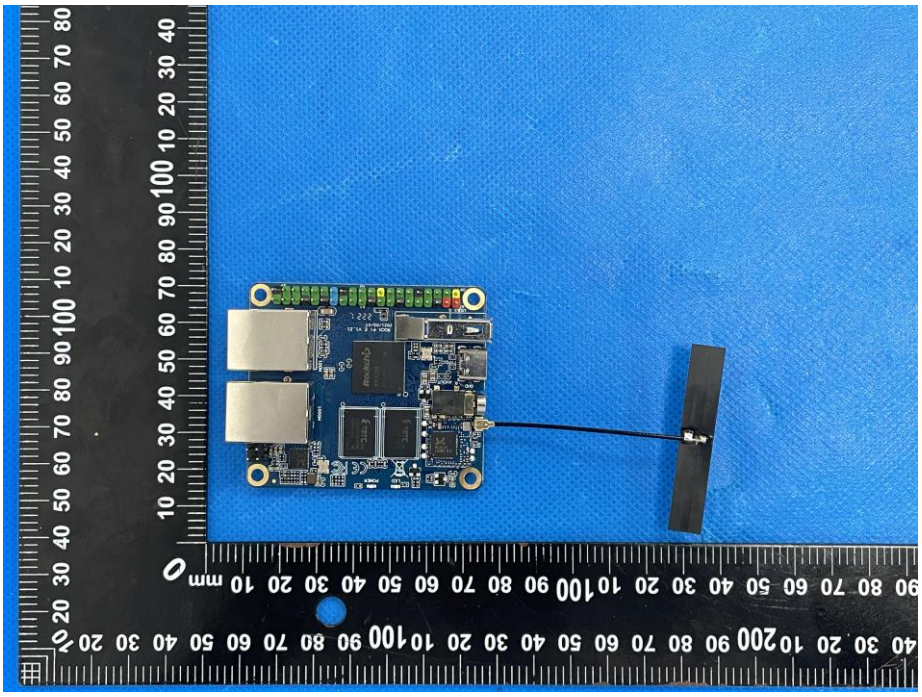
11.4 Test Result

The Worst mode 802.11a

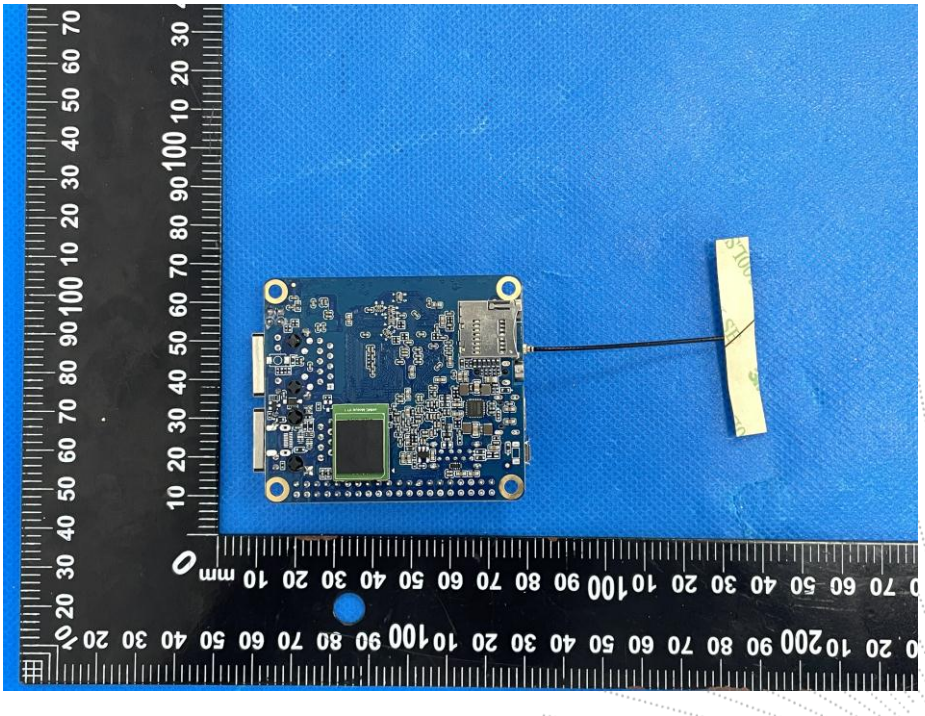
Receiver category 2				
Channel Frequency (MHz)	unwanted test signal Frequency	Signal generator B (Level)	Limit (dBm)	Margin (dBm)
5745	Centre Frequency – 10*BW	-63.00	-72.41	-9.41
	Centre Frequency + 10*BW	-63.00		-9.41
	Centre Frequency – 20*BW	-59.00		-13.41
	Centre Frequency + 20*BW	-60.00		-12.41
	Centre Frequency – 50*BW	-43.00		-29.41
	Centre Frequency + 50*BW	-42.00		-30.41
5825	Centre Frequency – 10*BW	-65.00	-72.53	-7.53
	Centre Frequency + 10*BW	-61.00		-11.53
	Centre Frequency – 20*BW	-56.00		-16.53
	Centre Frequency + 20*BW	-57.00		-15.53
	Centre Frequency – 50*BW	-44.00		-28.53
	Centre Frequency + 50*BW	-43.00		-29.53
Receiver BW=16.684MHz; $K_{5745MHz}$=−20log 5.745 −10log16.684=-27.41 $K_{5825MHz}$=−20log 5.825 −10log16.684=-27.53				

12. EUT Photographs

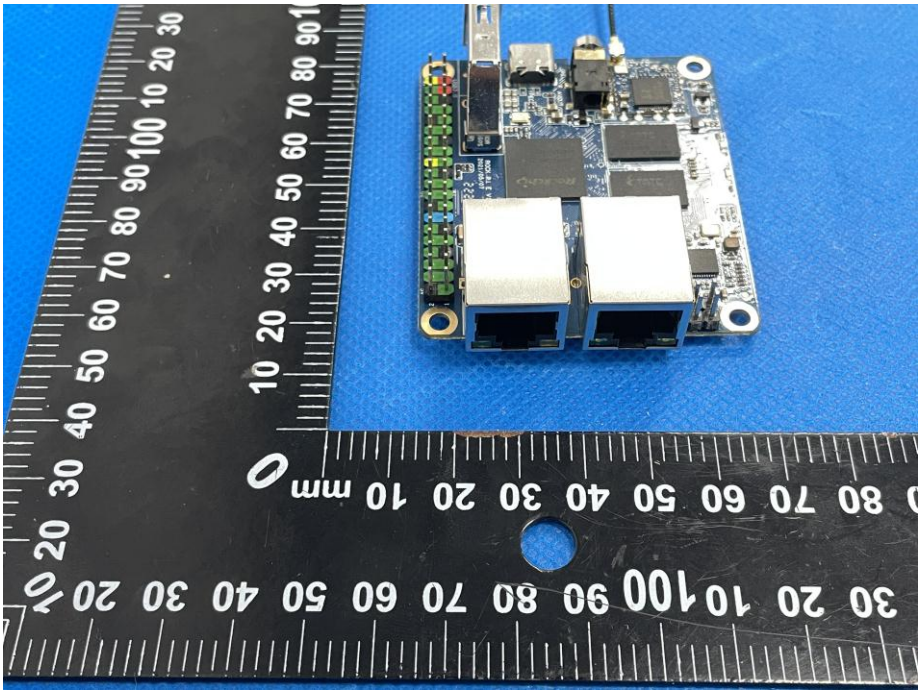
EUT Photo 1



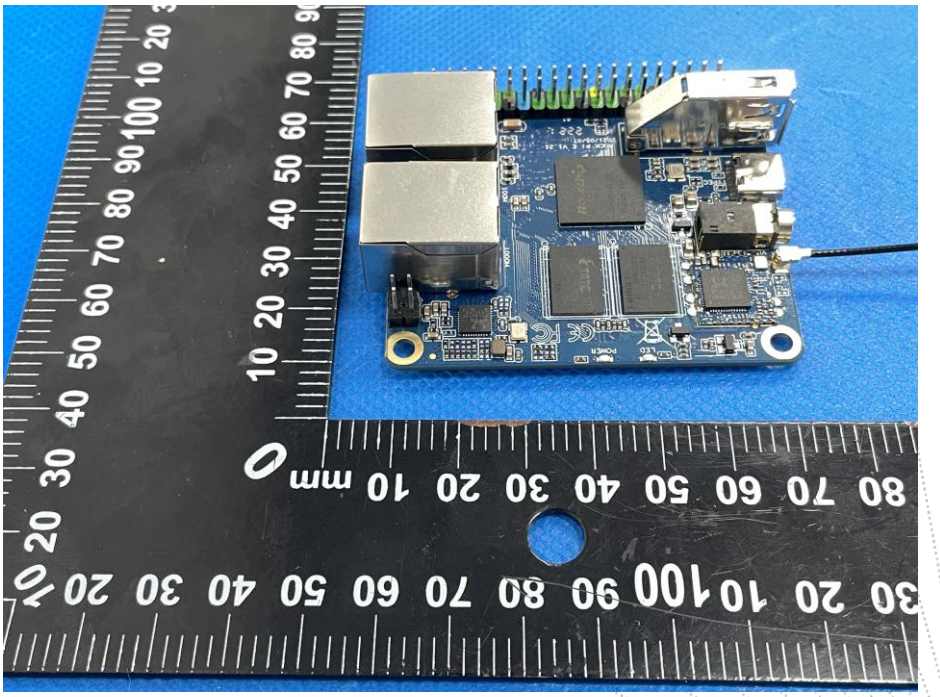
EUT Photo 2



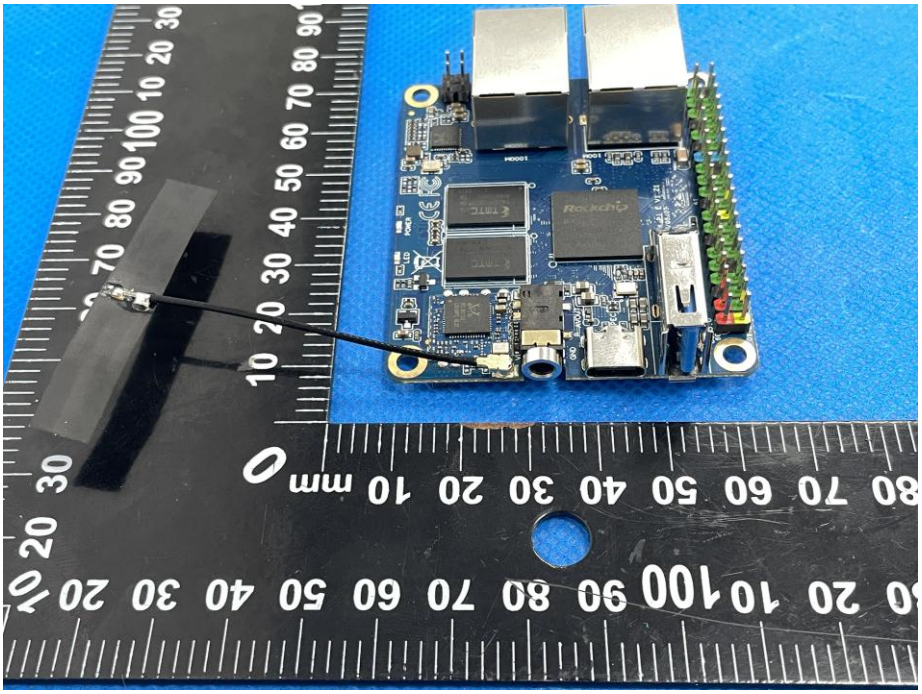
EUT Photo 3



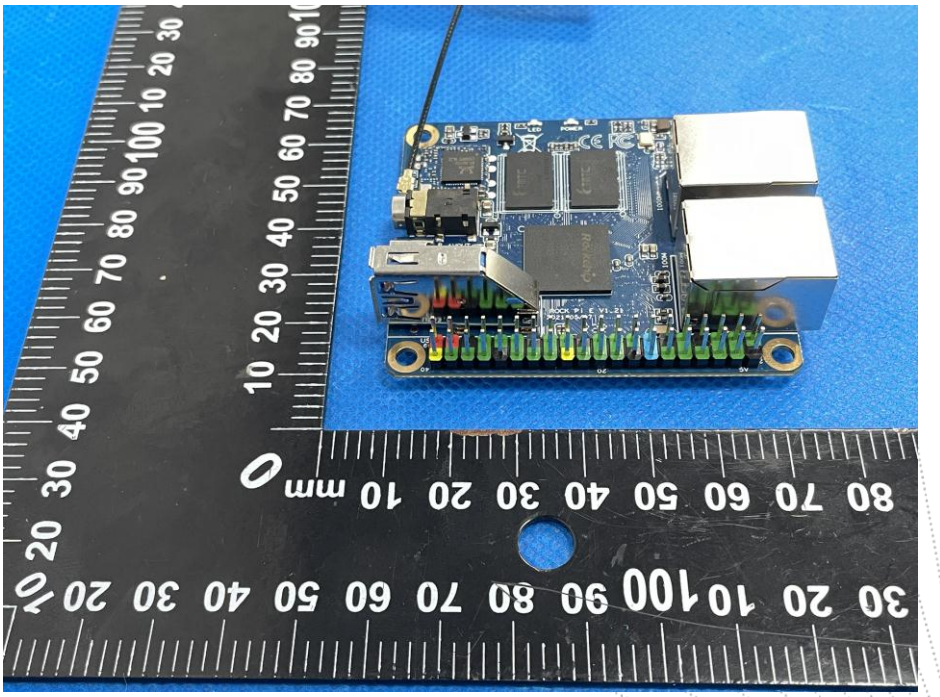
EUT Photo 4



EUT Photo 5

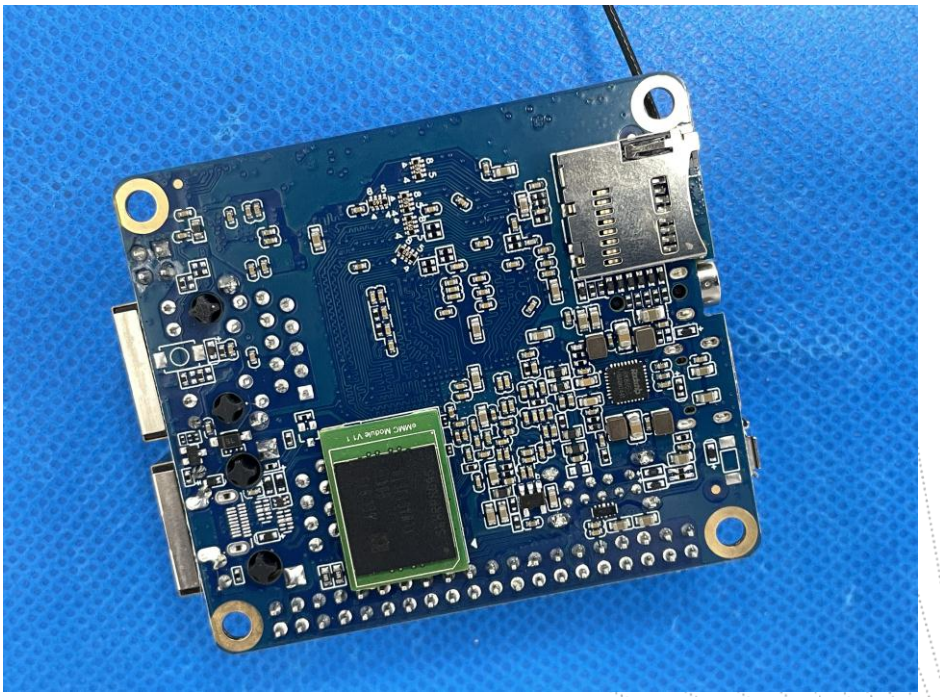


EUT Photo 6

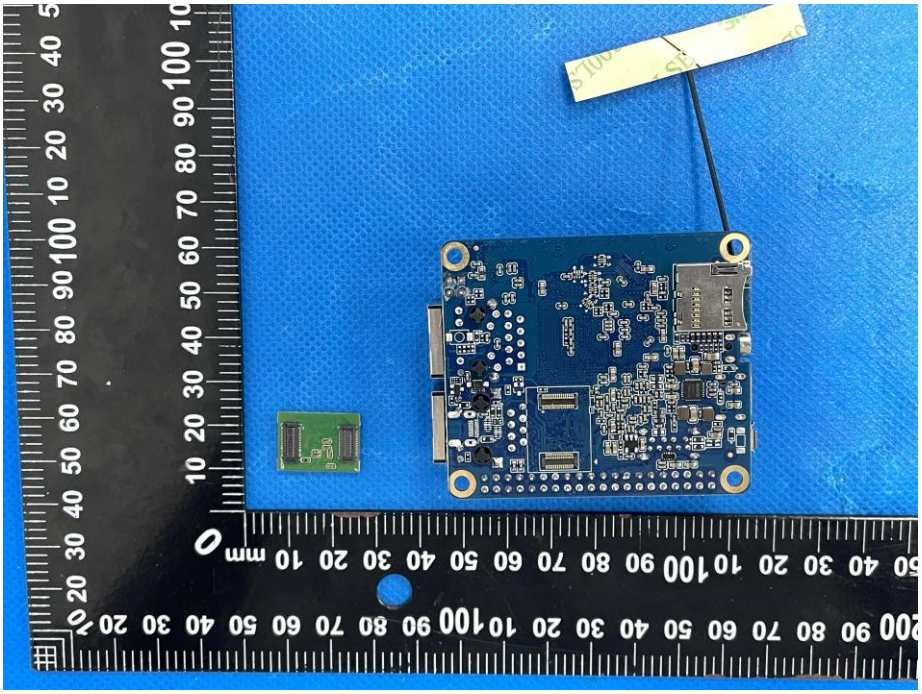


EUT Photo 7

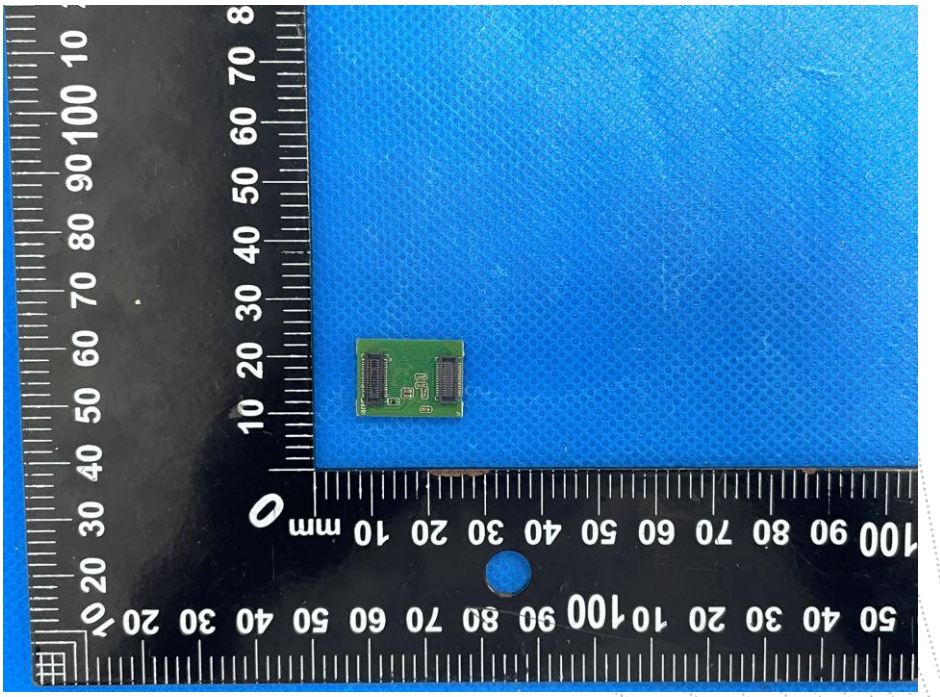
EUT Photo 8



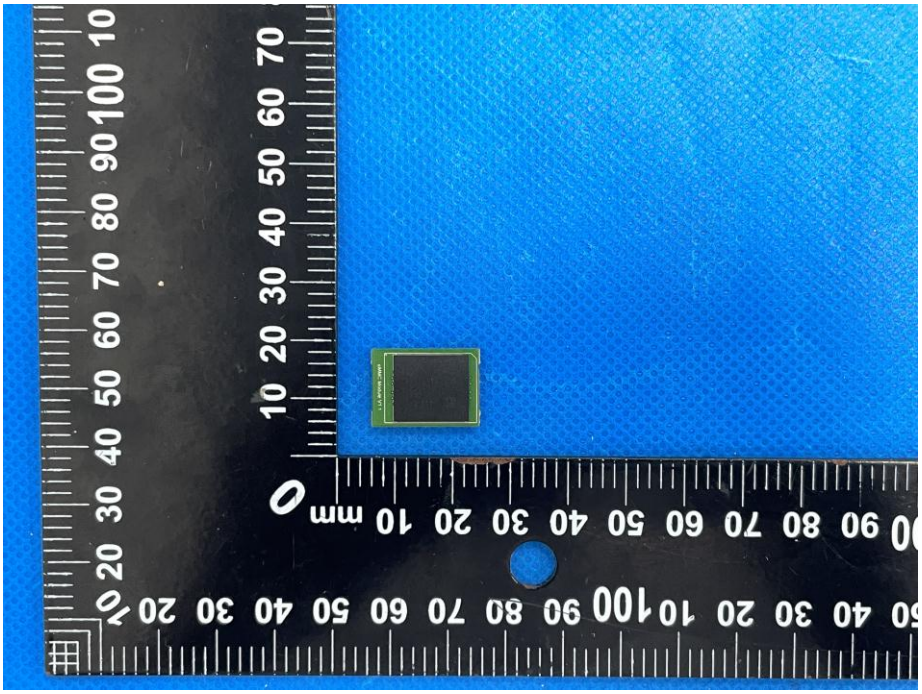
EUT Photo 9



EUT Photo 10



EUT Photo 11



13. EUT Test Setup Photographs

Spurious emissions

STATEMENT

1.The equipment lists are traceable to the national reference standards.

2.The test report can not be partially copied unless prior written approval is issued from our lab.

3.The test report is invalid without stamp of laboratory.

4.The test report is invalid without signature of person(s) testing and authorizing.

5.The test process and test result is only related to the Unit Under Test.

6.The quality system of our laboratory is in accordance with ISO/IEC17025.

7.If there is any objection to report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

Address:
1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

TEL：400-788-9558

P.C.: 518103

FAX：0755-33229357

Website：http://www.chnbctc.com

E-Mail：bctc@bctc-lab.com.cn

※※※※※ **END** ※※※※※