Prüfbericht-Nr.: *Test Report No.*:	**501938571 001**	**Auftrags-Nr.:** *Order No.*:	14082189	**Seite 1 von 50** *Page 1 of 50*
Kunden-Referenz-Nr.: *Client Reference No.*:	N/A	**Auftragsdatum:** *Order date*:	26-Sep-2018	
Auftraggeber: *Client*:	InnoComm Mobile Technology Corporation 3F, No. 6, Hsin Ann Rd., Hsinchu Science Park, Hsinchu, Taiwan, R.O.C.			
Prüfgegenstand: *Test item*:	Wireless audio module			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	WB10			
Auftrags-Inhalt: *Order content*:	FCC Test report (WiFi 5GHz)			
Prüfgrundlage: *Test specification*:	FCC CFR 47 Part 15 Subpart E Section 15.407			

Wareneingangsdatum: *Date of receipt*:	08-Oct-2018
Prüfmuster-Nr.: *Test sample No.*:	A000817010-002
Prüfzeitraum: *Testing period*:	8-Oct-2018 - 30-Oct-2018
Ort der Prüfung: *Place of testing*:	EMC/RF Laboratory Taipei
Prüflaboratorium: *Testing laboratory*:	TUV Rheinland Taiwan Ltd.
Prüfergebnis*: *Test result**:	Pass

geprüft von / *tested by*:			**kontrolliert von /** *reviewed by*:		
2018-11-1	Mars Y. J. Lin / Project Engineer		2018-11-1	Ryan W. T. Chen / Project Manager	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*:
The module has both modes with heat sink and without heat sink.
Both models of this report are evaluated, taking the Worst case test.

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery*:	Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.
V04

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT
RESULT: Passed

5.1.2 MAXIMUM CONDUCTED OUTPUT POWER
RESULT: Passed

5.1.3 ON TIME AND DUTY CYCLE

5.1.4 26 DB BANDWIDTH AND 99% BANDWIDTH
RESULT: Passed

5.1.5 6 DB BANDWIDTH
RESULT: Passed

5.1.6 POWER SPECTRAL DENSITY
RESULT: Passed

5.1.7 MASK EMISSION
RESULT: Passed

5.1.8 SPURIOUS EMISSION
RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS
RESULT: Passed

6.2.1 MAINS CONDUCTED EMISSIONS
RESULT: Passed

Contents

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix P: Photo Documentation internal view
(File Name: 501938571 001 Appendix P)
Appendix D: Test Result of Radiated Emissions
(File Name: 501938571 001 Appendix D)

Test Specifications

The following standards were applied:

Table 1: Applied Standard and Test Levels

Radio
FCC CFR 47 Part 15 Subpart E Section 15.407
FCC CFR 47 Part 2 Subpart J Section 2.1091
FCC CFR 47 Part 1 Subpart I Section 1.1307
ANSI C63.10:2013
FCC KDB 789033 D02
FCC KDB 662911
FCC KDB 644545
FCC KDB 447498 D01 General RF Exposure Guidance v06

2. Test Sites

2.1 Test Facilities

TUV Rheinland Taiwan Ltd.
Taipei Office

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC Registration No.: 340738
IC Canada Registration No.: 9465A-1

TAF Accredited NCC Test Lab. No.:0759
TAF ISO17025 Certification effective periods: 2016-Jul-1st to 2019-Jun-30th

Testing Laboratory
0759

2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Type	S/N	Last Calibration	Next Calibration
Test Software	Farad	EZ_EMC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR 7	101549	2017/11/10	2018/11/10
Spectrum Analyzer	R&S	FSV 40	100921	2018/05/02	2019/05/02
Spectrum Analyzer	Agilent	N9010A	MY53470241	2018/02/05	2019/02/05
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2018/08/14	2019/08/14
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	2018/01/18	2019/01/18
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	60558	2017/11/21	2018/11/21
Bilog Antenna	TESEQ	CBL6111D	29804	2018/08/18	2019/08/18
Horn Antenna	ETS-Lindgren	3117	201918	2018/08/18	2019/08/18
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840	101029	2017/11/28	2018/11/28
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2018/06/14	2019/06/14
EMI Test Receiver	R&S	ESR 7	101549	2017/11/10	2018/11/10
Spectrum Analyzer	R&S	FSL3	101943	2018/09/07	2019/09/07
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2017/03/09	2019/03/09
LISN (1 phase)	R&S	ENV216	101243	2018/06/18	2019/06/18
LISN	R&S	ENV216	101262	2018/06/22	2019/06/21

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular schedule using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are:

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 10^{-7}
RF power, conducted	± 1.5 dB
Adjacent channel power	± 3 dB
Radiated emission of transmitter, valid up to 40 GHz	± 6 dB
Radiated emission of receiver, valid up to 40 GHz	± 6 dB
Temperature	± 2 ºC
Humidity	± 10 %

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Wireless audio module. It contains both Bluetooth and WiFi compatible module enabling the user to communicate data through a Wireless interface.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 Ratings and System Details

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment	Wireless audio module
Type Designation	WB10
FCC ID	YAIWB10

Table 5: Technical Specification of EUT

Operating Frequency	5150 ~ 5250MHz
Operation Voltage	5Vdc
Channel number	Refer to Table 6
Modulation	802.11a/n/ac: OFDM with BPSK, QPSK, QAM
Antenna gain	5.63dBi
Antenna Type	PCB Antenna

Table 6: Channel Frequency Table

There are one bandwidth systems.

For 20MHz bandwidth systems, use channel 36, 40, 44, 48
For 40MHz Bandwidth systems, use channel 38, 46,
For 80MHz Bandwidth systems, use channel 42,

	CH	Frequency (MHz)
5150 ~ 5250MHz	36	5180
	38	5190
	40	5200
	42	5210
	44	5220
	46	5230
	48	5240

3.3 Independent Operation Modes

The basic operation modes are:

A. Transmitting
B. Receiving
C. Normal link
D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Description of Test Setup

4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Table 7: Table for Parameters of Test Software Setting

Mode	Channel Frequency					
	NCB: 20MHz			NCB: 40MHz		NCB: 80MHz
	5180 MHz	5200 MHz	5240 MHz	5190 MHz	5230 MHz	5210 MHz
802.11a	9	9	9	x	x	x
802.11ac VHT20	8.5	8	8	x	x	x
802.11ac VHT40	x	x	x	8.5	8	x
802.11ac VHT80	x	x	x	x	x	5

4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with a USB interface which makes it possible to control them through a test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate.

The samples were used as follows:
A000817010-002

Full test was applied on all test modes, but only worst case was shown

IEEE 802.11a mode:
Channel Low (5180MHz), Channel Mid (5200MHz) and Channel High (5240MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11ac VHT20 mode:
Channel Low (5180MHz), Channel Mid (5200MHz) and Channel High (5240MHz) with MCS0/NSS1 data rate were chosen for full testing.

IEEE 802.11ac VHT40 mode:
Channel Low (5190MHz) and Channel High (5230MHz) with MCS0/NSS1 data rate were chosen for full testing.

IEEE 802.11ac VHT80 mode:
Channel Low (5210MHz) with MCS0/NSS1 data rate were chosen for full testing.

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test

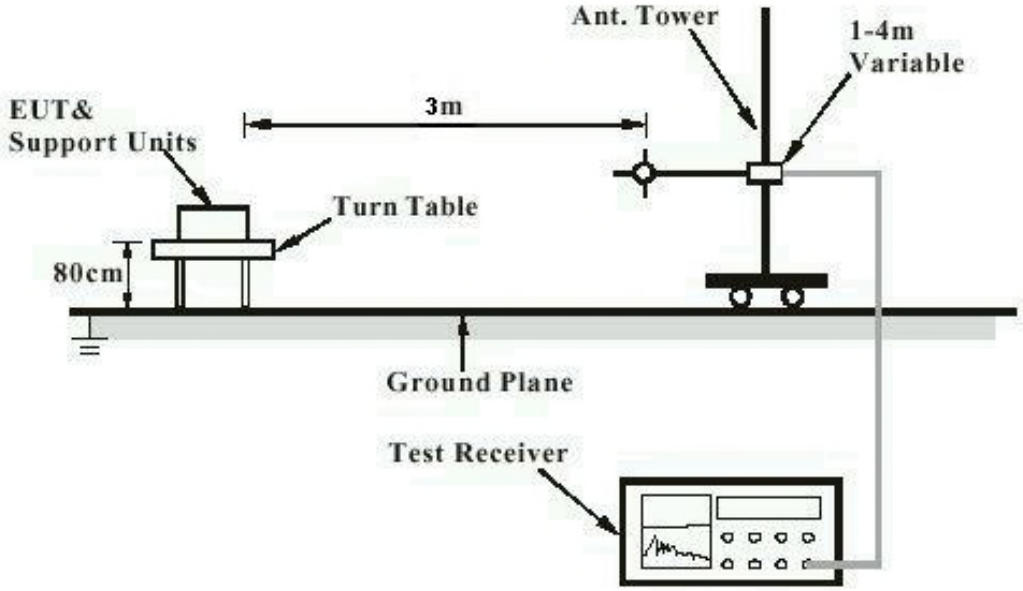


Diagram of Measurement Equipment Configuration for Mains Conduction Measurement

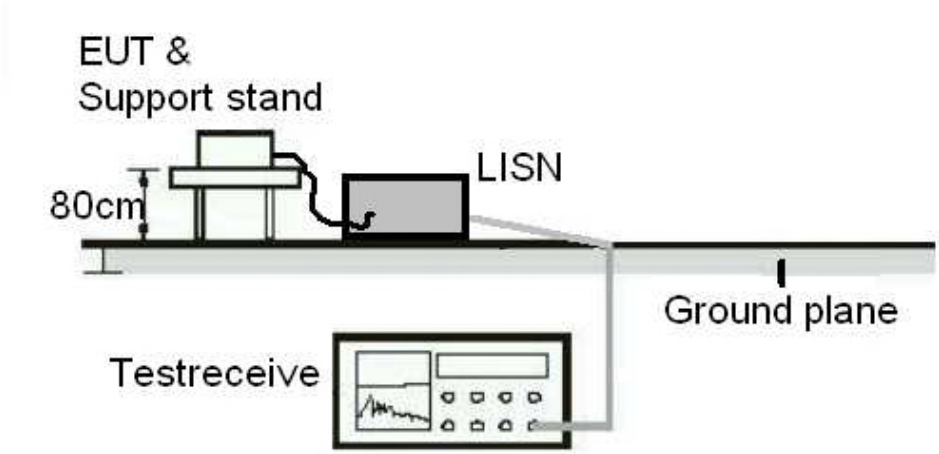
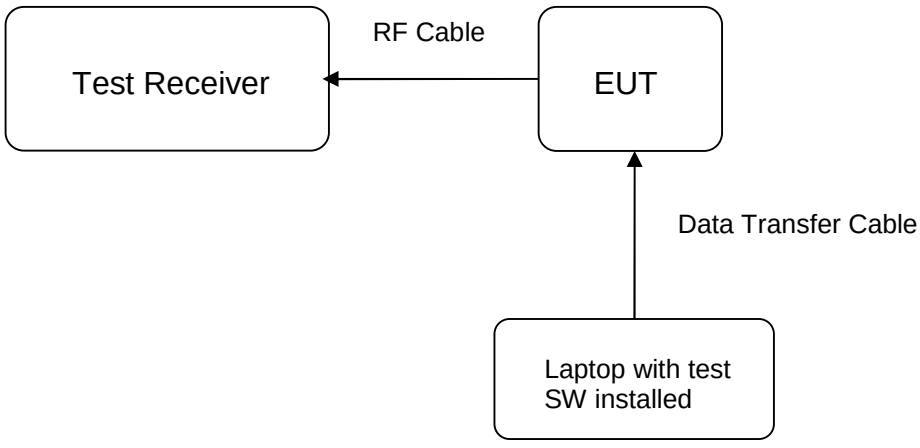


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement

ANT1 or ANT2 testing



4.6 Environmental Conditions

Temperature	18 - 25˚C
Humidity	35 – 75%

5. Antenna Port Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT: **Passed**

Test standard	:	FCC Part 15.407(a), Part 15.203
Limit	:	the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 5.63 dBi. The antenna is a PCB Antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

5.1.2 Maximum Conducted Output Power

RESULT: **Passed**

Test standard	:	FCC Part 15.407(a)
Kind of test site	:	Shielded room/Conducted room

Test setup

Test Channel	:	Refer to the Table 9 ~ 12
Operation Mode	:	A

Limit

For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

Table 8: Test result of Maximum Output Power (802.11a)

Channel	Frequency	Conducted power (dBm)		Total (dBm)	Max. Limit (dBm)	RESULT
		Ant1	Ant2			
36	5180 MHz	11.15	9.73	13.51	24	Pass
40	5200 MHz	11.08	9.83	13.51	24	Pass
48	5240 MHz	11.24	9.93	13.64	24	Pass

Table 9: Test result of Maximum Output Power (802.11ac VHT20)

Channel	Frequency	Conducted power (dBm)		Total (dBm)	Max. Limit (dBm)	RESULT
		Ant1	Ant2			
36	5180 MHz	10.06	8.51	12.36	24	Pass
40	5200 MHz	9.75	8.53	12.19	24	Pass
48	5240 MHz	10.02	9.11	12.6	24	Pass

Table 10: Test result of Maximum Output Power (802.11ac VHT40)

Channel	Frequency	Conducted power (dBm)		Total (dBm)	Max. Limit (dBm)	RESULT
		Ant1	Ant2			
38	5190 MHz	9.85	8.89	12.41	24	Pass
46	5230 MHz	9.78	8.77	12.31	24	Pass

Table 11: Test result of Maximum Output Power (802.11ac VHT80)

Channel	Frequency	Conducted power (dBm)		Total (dBm)	Max. Limit (dBm)	RESULT
		Ant1	Ant2			
42	5210 MHz	6.67	5.68	9.21	24	Pass

5.1.3 On Time and Duty Cycle

Test standard	:	KDB 789033 Zero-Span Spectrum Analyzer Method
Limit	:	None; for reporting purposes only
Kind of test site	:	Shielded room/Conducted room

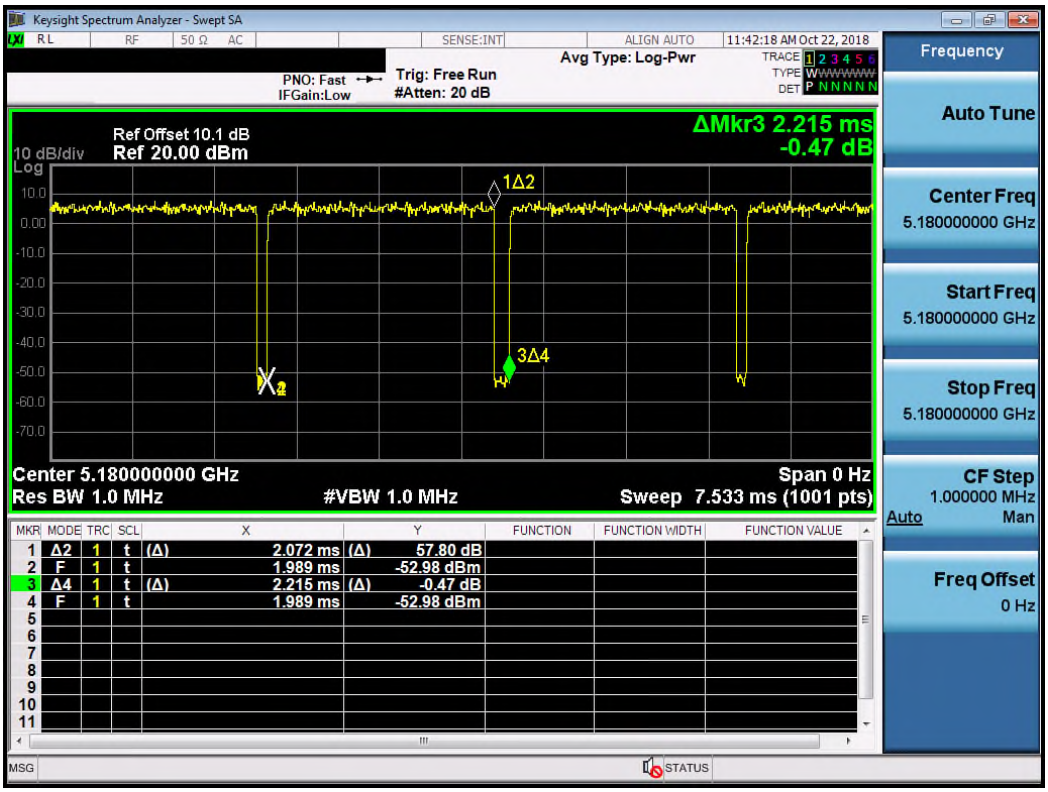
Test setup

Operation Mode	:	A

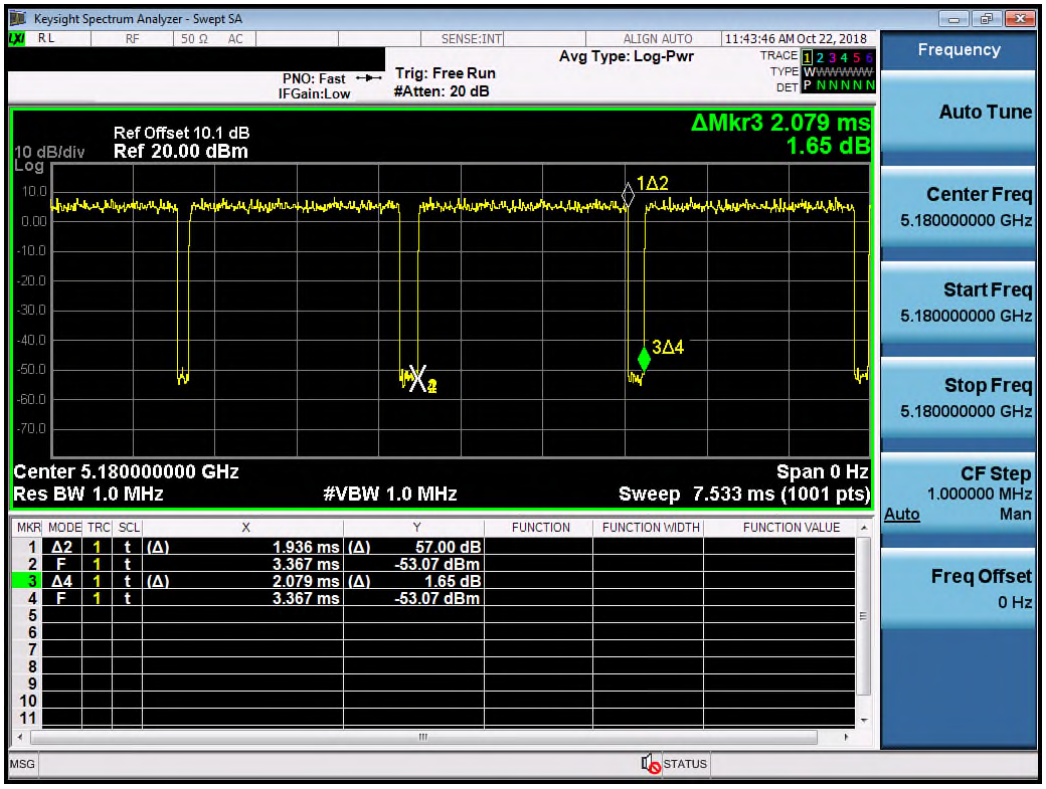
Table 12: Result of Duty Cycle

Mode	On Time(ms)	On+Off Time(ms)	Duty Cycle(%)	Duty Factor(dB)	1/T Minimum VBW(kHz)
802.11a	2.070	2.170	95.39%	0.20	0.48
802.11ac VHT20	1.920	2.110	91.00%	0.41	0.52
802.11ac VHT40	0.960	1.050	91.43%	0.39	1.04
802.11ac VHT80	0.450	0.580	77.59%	1.10	2.22

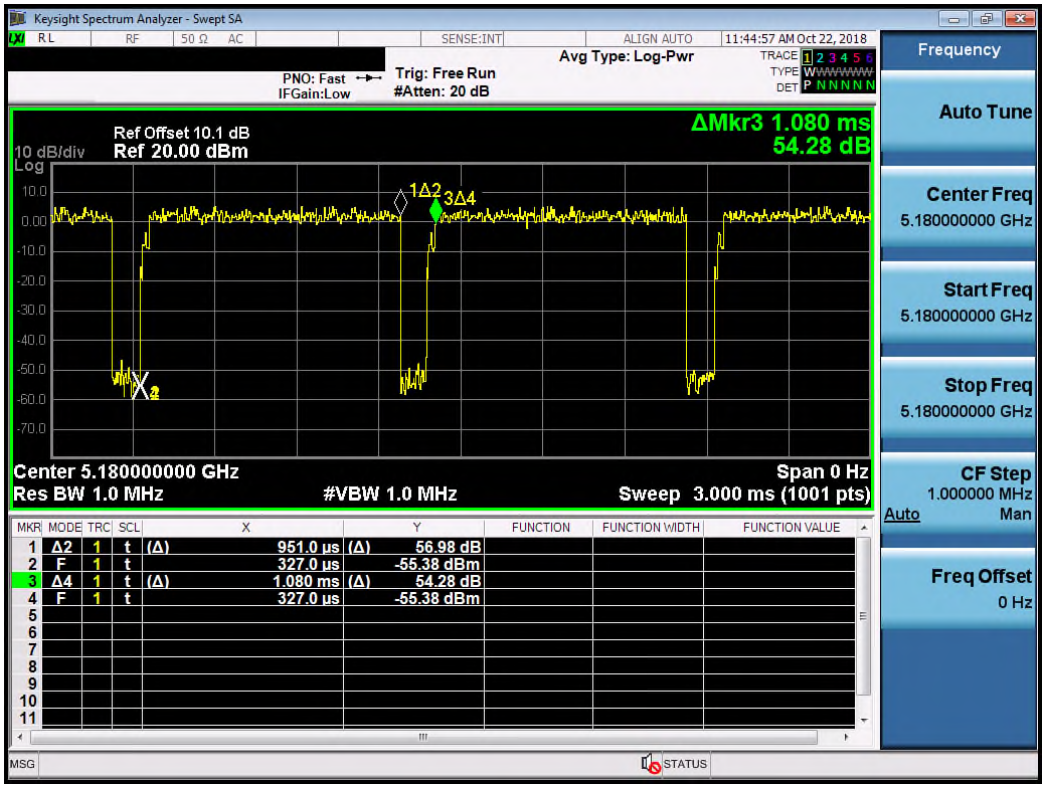
DUTY CYCLE PLOT, 802.11a



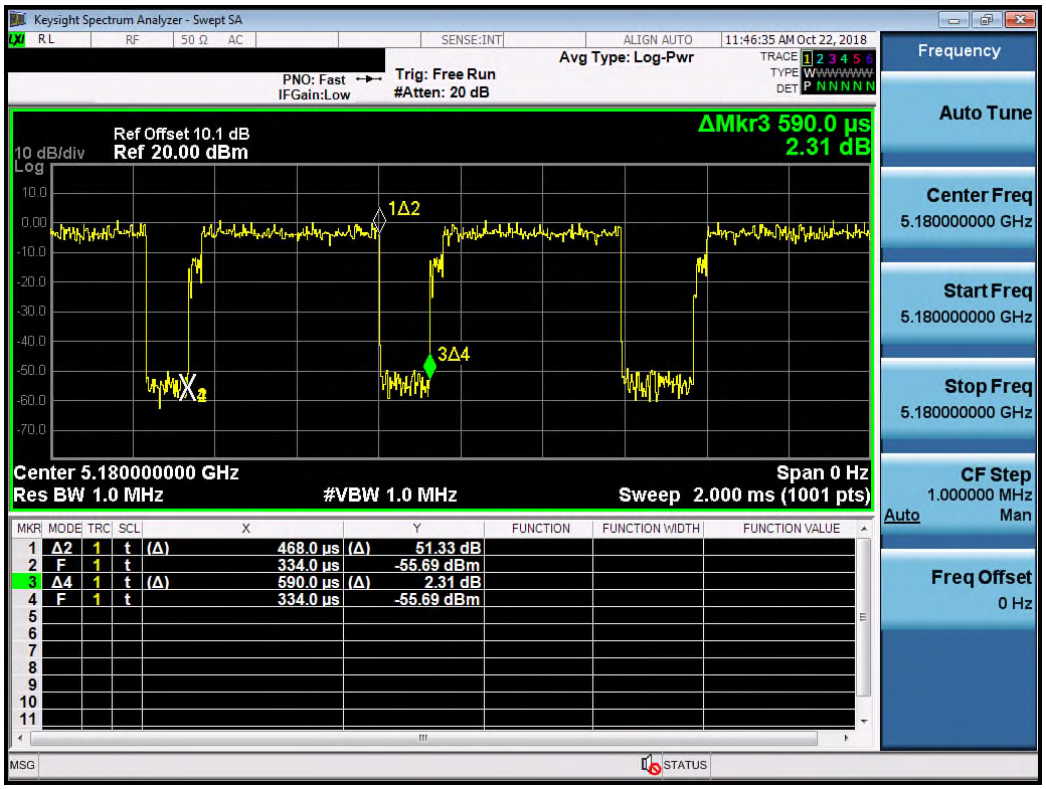
DUTY CYCLE PLOT, 802.11ac VHT20



DUTY CYCLE PLOT, 802.11ac VHT40



DUTY CYCLE PLOT, 802.11ac VHT80



5.1.4 26 dB Bandwidth and 99% Bandwidth

RESULT: **Passed**

Test standard	:	FCC Part 15.407(a)
Limit	:	FCC Part 15.407(a)
Kind of test site	:	Shielded room/Conducted room

Test setup

Test Channel	:	Refer to the Table 11 ~14
Operation Mode	:	A

Table 13: Test result of 26dB/99% Bandwidth (802.11a)

Channel	Channel Frequency (MHz)	26dB Bandwidth ANT0+ANT1 (MHz)	99% Bandwidth ANT0+ANT1 (MHz)
36	5180	18.97	16.432
40	5200	18.98	16.430
48	5240	18.81	16.437

Table 14: Test result of 26dB/99% Bandwidth (802.11ac VHT20)

Channel	Channel Frequency (MHz)	26dB Bandwidth ANT0+ANT1 (MHz)	99% Bandwidth ANT0+ANT1 (MHz)
36	5180	20.55	17.533
40	5200	20.17	17.550
48	5240	20.66	17.555

Note1: Channel 144 is operated in both U-NII-2C and U-NII-3

Table 15: Test result of 26dB/99% Bandwidth (802.11ac VHT40)

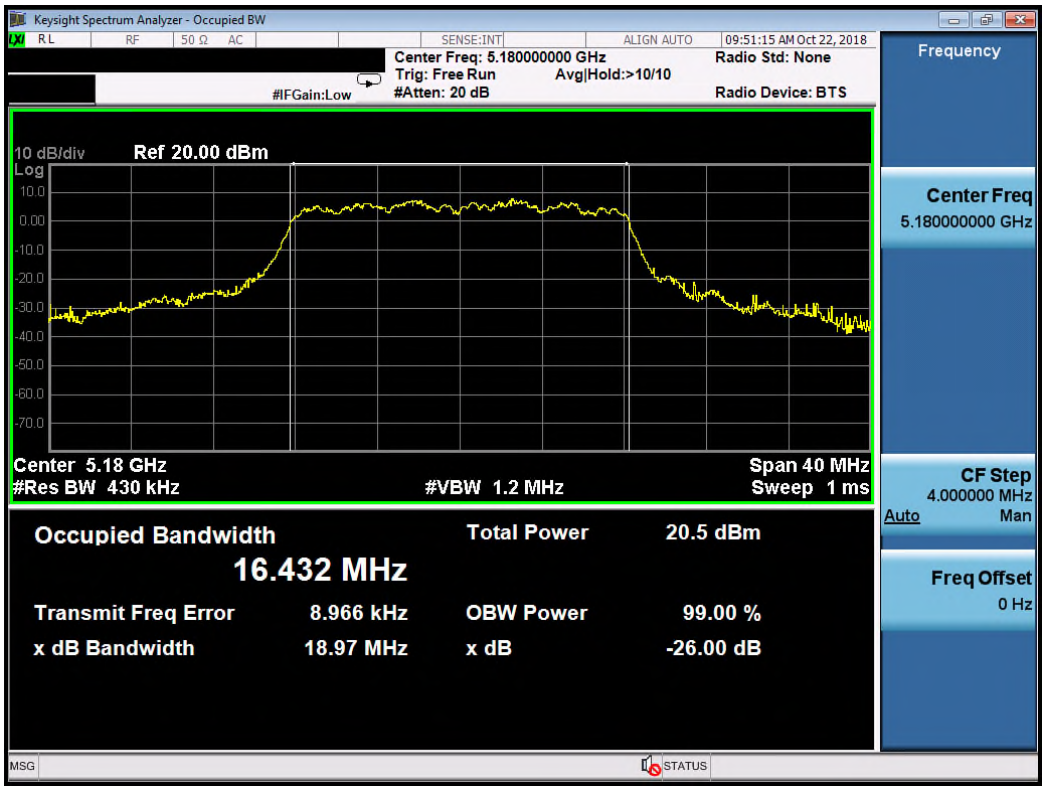
Channel	Channel Frequency (MHz)	26dB Bandwidth ANT0+ANT1 (MHz)	99% Bandwidth ANT0+ANT1 (MHz)
38	5190	40.67	35.945
46	5230	42.28	35.960

Table 16: Test result of 26dB/99% Bandwidth (802.11ac VHT80)

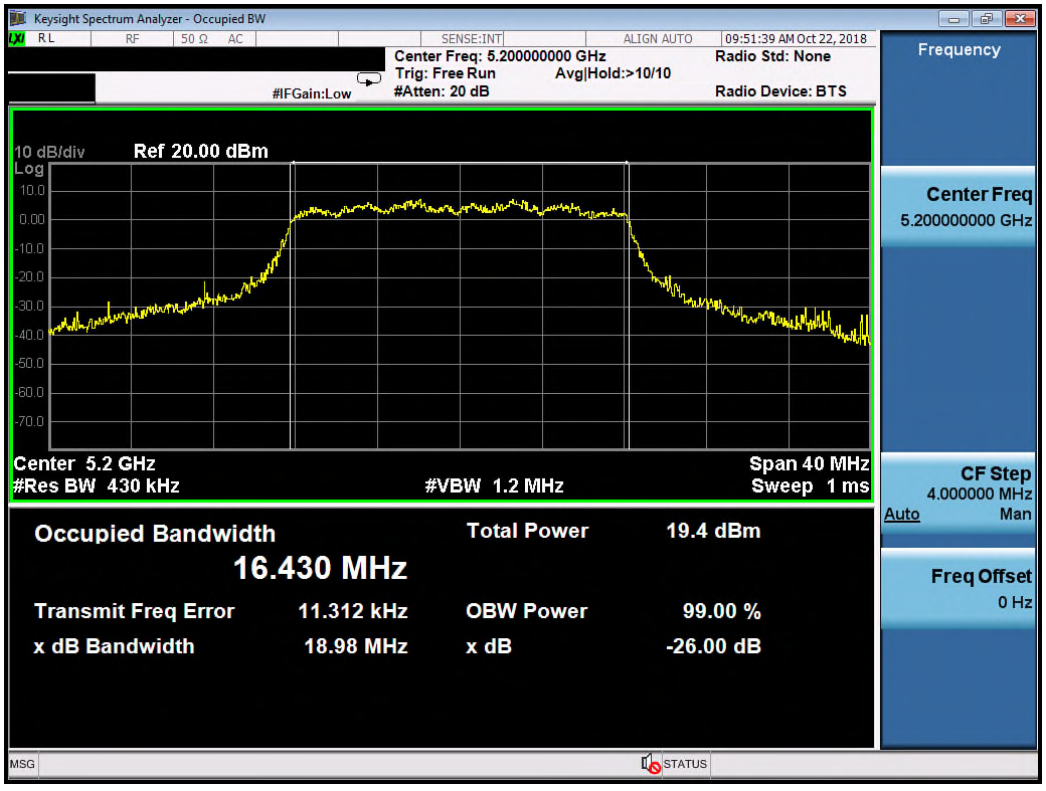
Channel	Channel Frequency (MHz)	26dB Bandwidth ANT0+ANT1 (MHz)	99% Bandwidth ANT0+ANT1 (MHz)
42	5210	82.34	75.074

Test Plot of 26dB+99% Bandwidth (802.11a)

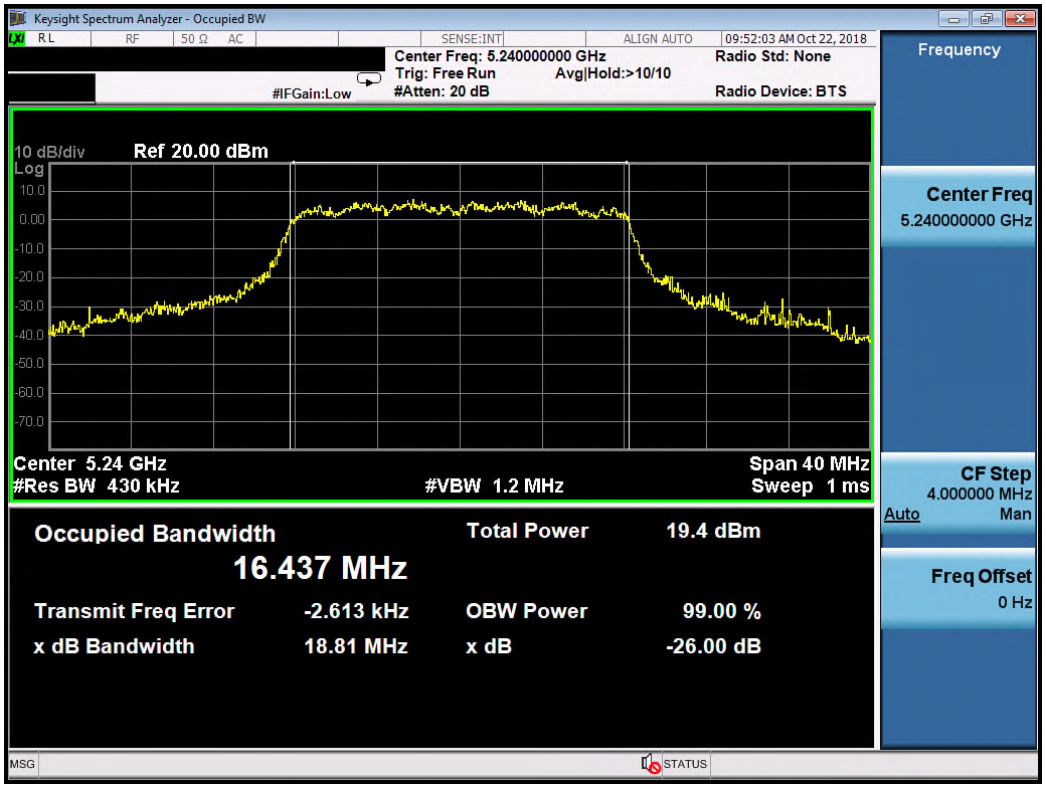
5180MHz



5200MHz

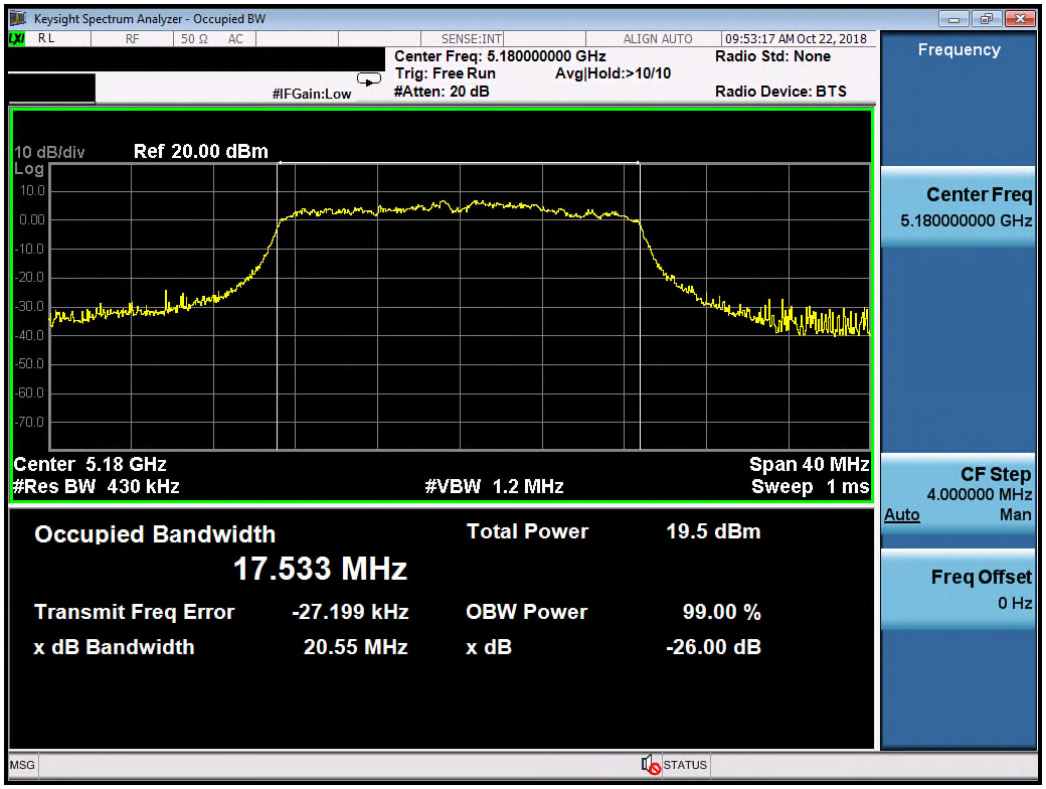


5240MHz

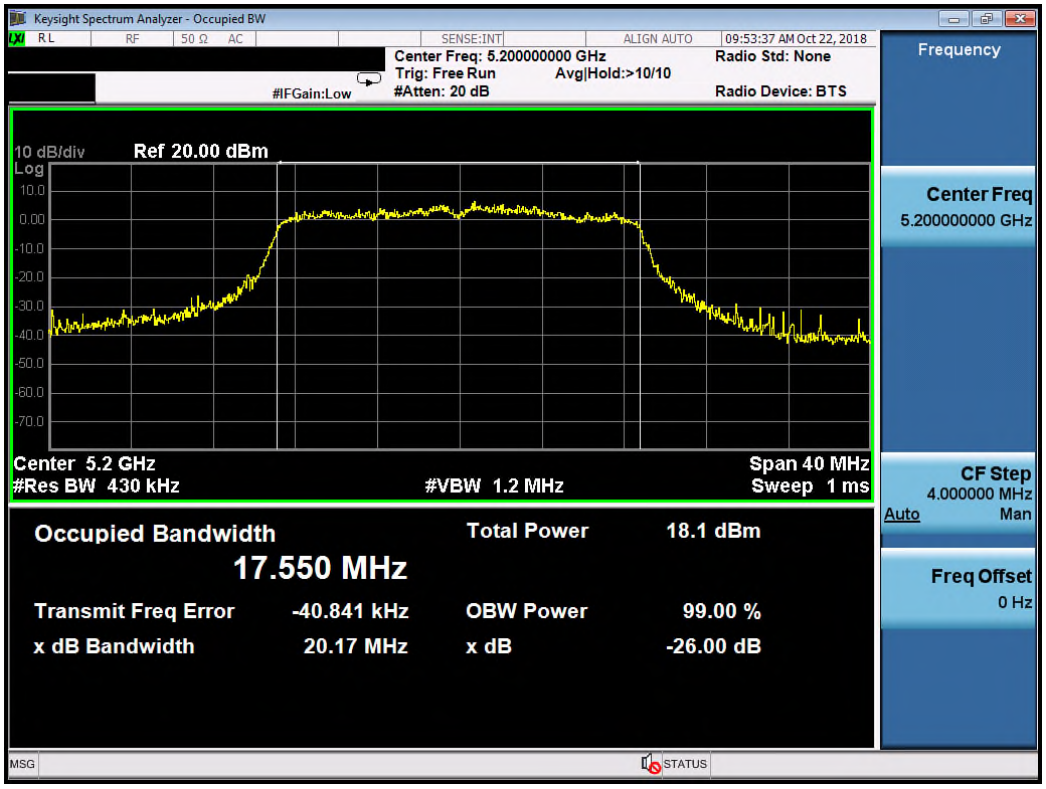


Test Plot of 26dB+99% Bandwidth (802.11ac VHT20)

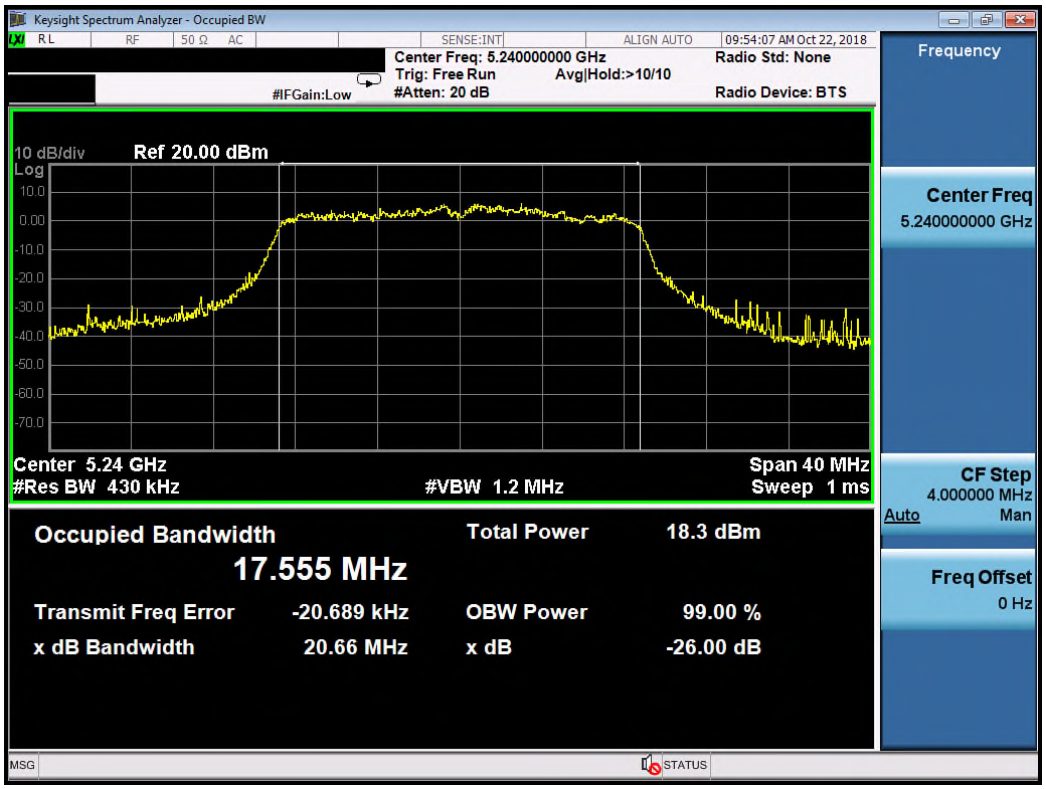
5180MHz



5200MHz

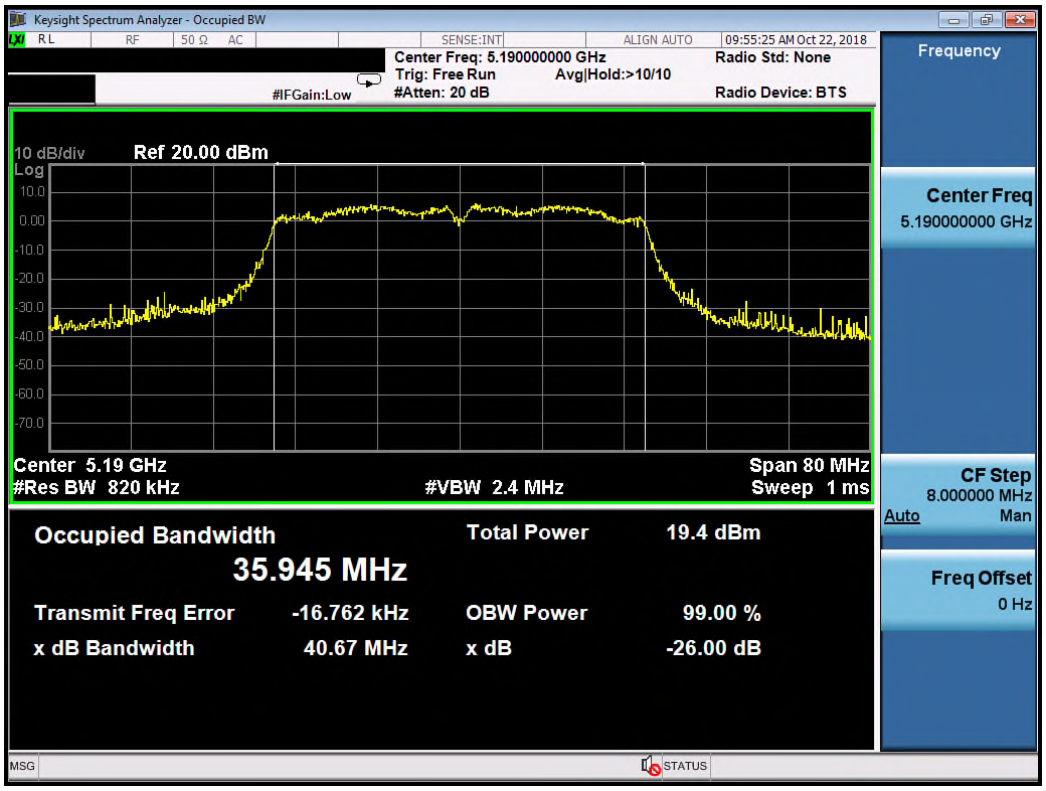


5240MHz

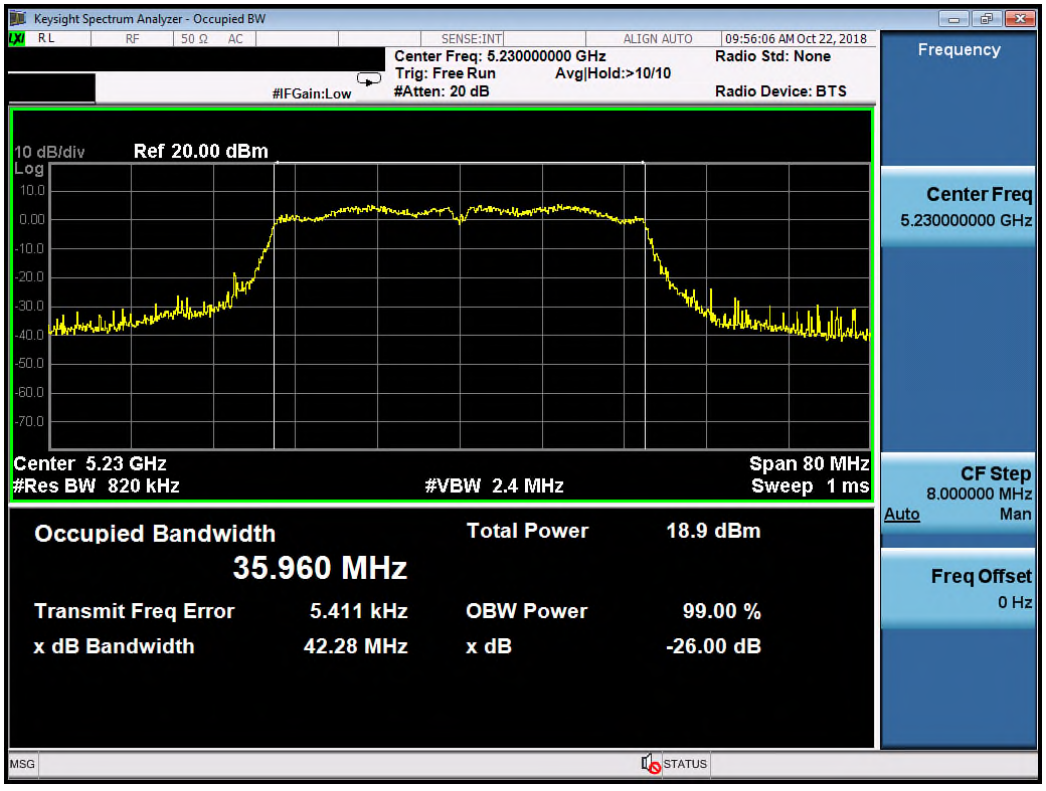


Test Plot of 26dB+99% Bandwidth (802.11ac VHT40)

5190MHz

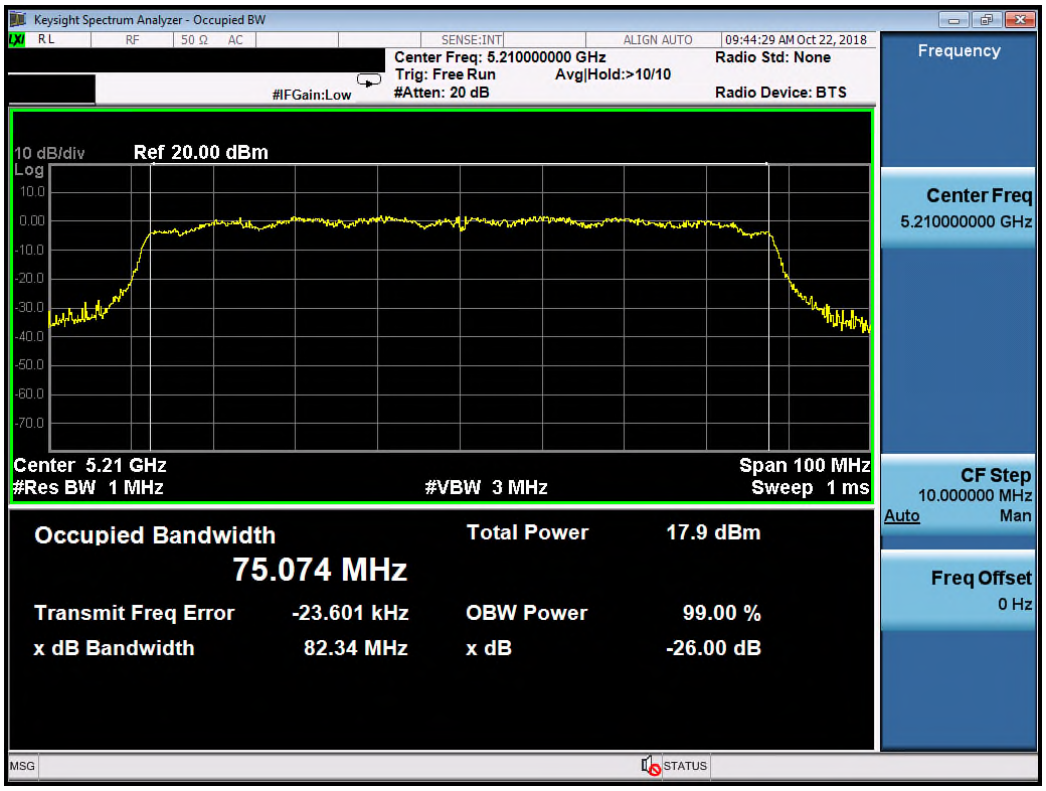


5230MHz



Test Plot of 26dB+99% Bandwidth (802.11ac VHT80)

5210MHz



5.1.5 Power Spectral Density

RESULT: **Passed**

Test standard	:	FCC Part 15.407(a)(1),(3)
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Refer to the table 19 ~ 22
Operation Mode	:	A

Limit

For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

Table 17: Test result of Power Spectral Density (802.11a)

5150-5250MHz

Channel	Channel Frequency (MHz)	ANT1 (dBm)	ANT2 (dBm)	Total (dBm)	Limit (dBm/MHz)	Result
36	5180	-3.747	-5.329	-1.46	8.36	Pass
40	5200	-4.095	-5.120	-1.57	8.36	Pass
44	5240	-3.880	-5.454	-1.59	8.36	Pass

Note: Directional gain = G_{ANT} + 10 log (N_{ANT}) dBi = 5.63dBi+3.01dBi = 8.64dBi, so limit = 8.36dBm

Table 18: Test result of Power Spectral Density (802.11ac VHT20)

5150-5250MHz

Channel	Channel Frequency (MHz)	ANT1 (dBm)	ANT2 (dBm)	Total (dBm)	Limit (dBm/MHz)	Result
36	5180	-4.619	-6.633	-2.50	8.36	Pass
40	5200	-4.946	-6.382	-2.59	8.36	Pass
44	5240	-5.147	-6.164	-2.62	8.36	Pass

Note: Directional gain = G_{ANT} + 10 log (N_{ANT}) dBi = 5.63dBi+3.01dBi = 8.64dBi, so limit = 8.36dBm

Table 19: Test result of Power Spectral Density (802.11ac VHT40)

5150-5250MHz

Channel	Channel Frequency (MHz)	ANT1 (dBm)	ANT2 (dBm)	Total (dBm)	Limit (dBm/MHz)	Result
38	5190	-8.312	-9.849	-6.00	8.36	Pass
46	5230	-9.113	-9.577	-6.33	8.36	Pass

Note: Directional gain = G_{ANT} + 10 log (N_{ANT}) dBi = 5.63dBi+3.01dBi = 8.64dBi, so limit = 8.36dBm

Table 20: Test result of Power Spectral Density (802.11ac VHT80)

5150-5250MHz

Channel	Channel Frequency (MHz)	ANT1 (dBm)	ANT2 (dBm)	Total (dBm)	Limit (dBm/MHz)	Result
42	5210	-14.972	-16.741	-12.76	8.36	Pass

Note: Directional gain = G_{ANT} + 10 log (N_{ANT}) dBi = 5.63dBi+3.01dBi = 8.64dBi, so limit = 8.36dBm

Test Plot of Power Density (802.11a)

Antenna1: (5150-5250MHz)

5180MHz

5200MHz

5240MHz

Antenna2: (5150-5250MHz)

5180MHz

5200MHz

5240MHz

Test Plot of Power Density (802.11ac VHT20)

Antenna1: (5150-5250MHz)

5180MHz

5200MHz

5240MHz

Antenna2: (5150-5250MHz)

5180MHz

5200MHz

5240MHz

Test Plot of Power Density (802.11ac VHT40)

Antenna1: (5150-5250MHz)

5190MHz

5230MHz

Antenna2: (5150-5250MHz)

5190MHz

5230MHz

Test Plot of Power Density (802.11ac VHT80)

Antenna1: (5150-5250MHz)

5210MHz

Antenna2: (5150-5250MHz)

5210MHz

5.1.6 Spurious Emission

RESULT: **Passed**

Test standard	:	FCC 15.205, FCC 15.209, FCC15.407
Basic standard	:	ANSI C63.10: 2013
Limits	:	Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a), must comply with the radiated emission limits specified in FCC 15.209(a) . Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a) and FCC 15.249(a).
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Refer to Appendix D
Operation mode	:	A

Remark: Testing was carried out within frequency range 30MHz to the tenth harmonic. For details refer to Appendix D. The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The Z Axis orientation is the worst-case and recorded in this test report. Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT: **Passed**

Test standard : FCC CFR 47 Part 2 Subpart J Section 2.1091

Separation distance is more than 20 cm, thus mobile device exposure limits can be applied.

Note: 5G Wi-Fi cannot be transmitting at same time with 2.4G Wi-Fi.

Maximum Exposure:

Power to Antenna (mW)	23.12 mW
Power to Antenna (dBm)	13.6 dBm
Antenna Gain	5.63 dBi
Power+Ant Gain	84.5 mW
Distance	20 cm
S=	0.017 mW/cm^2

Limit FCC:
1500-100,000 MHz 1.0 mW/cm^2

---End---

6.2 Mains Emissions

6.2.1 Mains Conducted Emissions

RESULT: **Passed**

Test standard	:	FCC Part 15.207 FCC Part 15.107
Limits	:	Mains Conducted emissions as defined in above standards
Kind of test site	:	Shielded Room

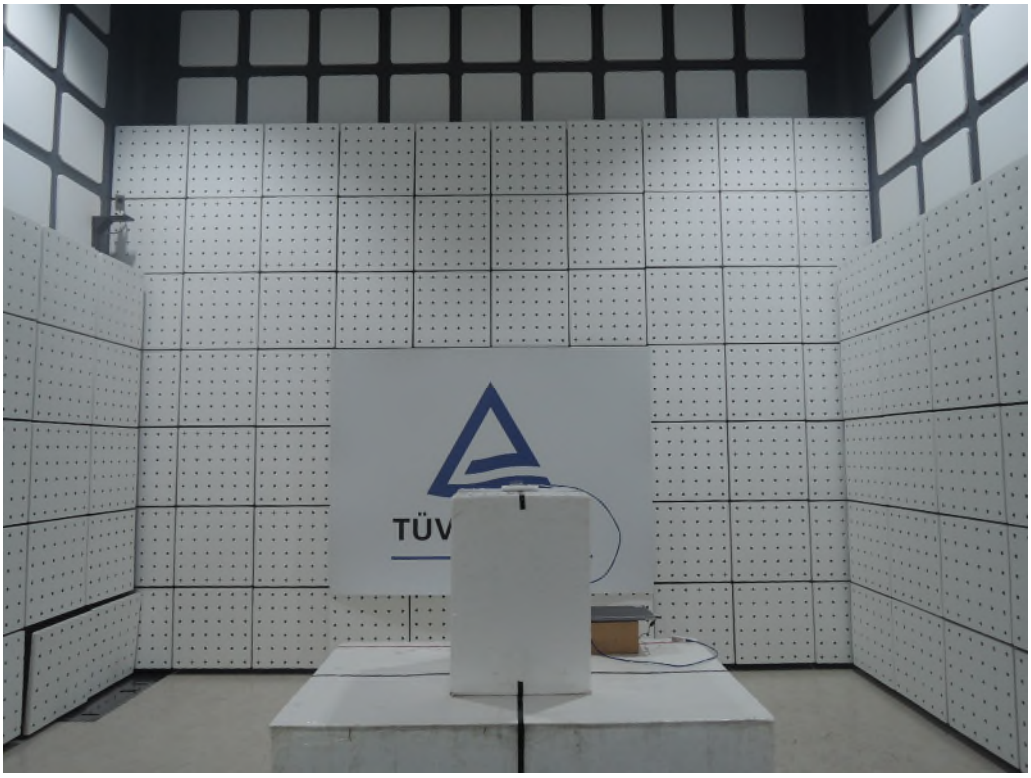
Test setup

Operation mode	:	C

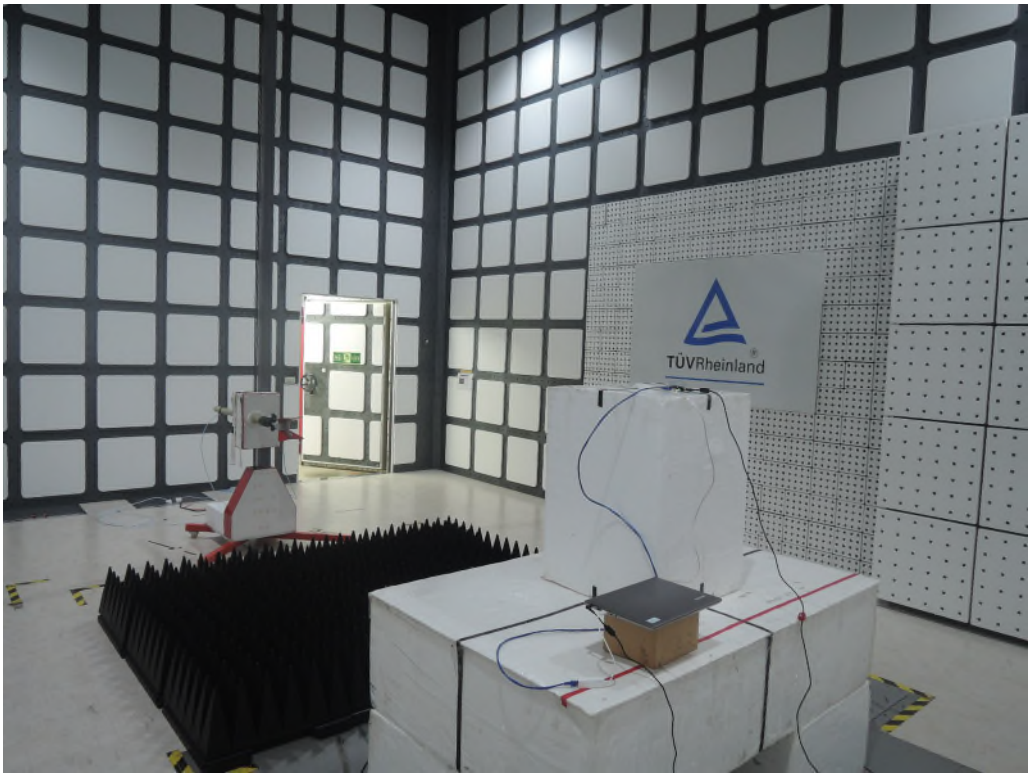
Remark: For details refer to Appendix D.

Photographs of the Test Set-Up

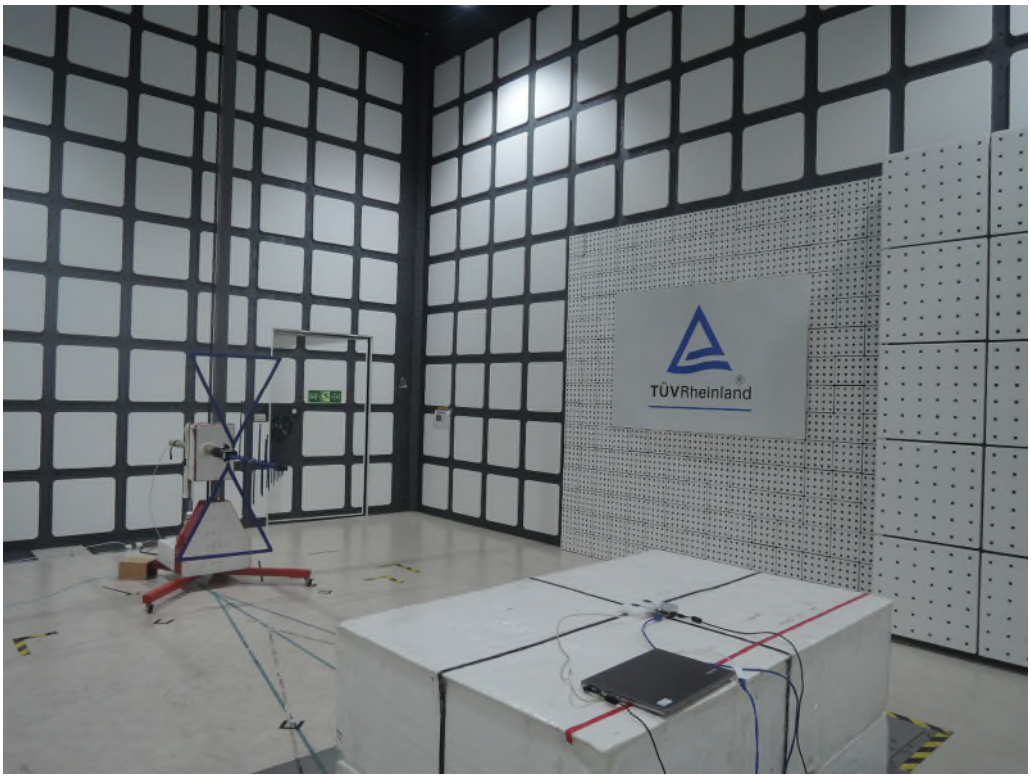
Photograph 1: Set-up for Spurious Emissions (Front View)



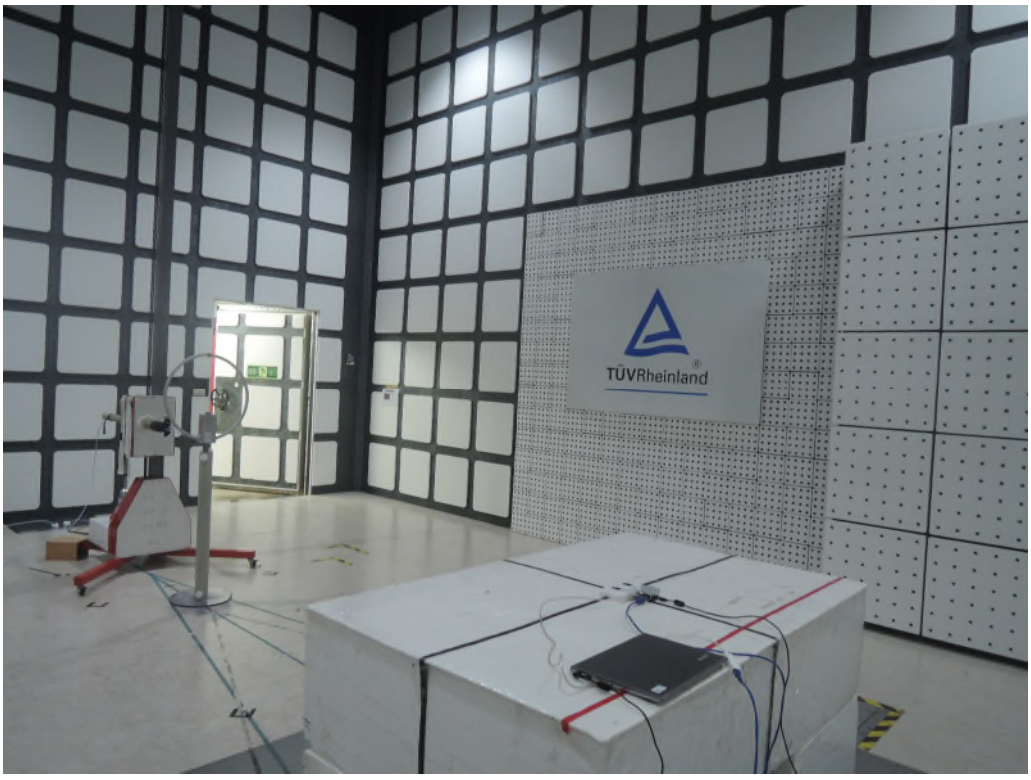
Photograph 2: Set-up for Spurious Emissions (Back View 1)



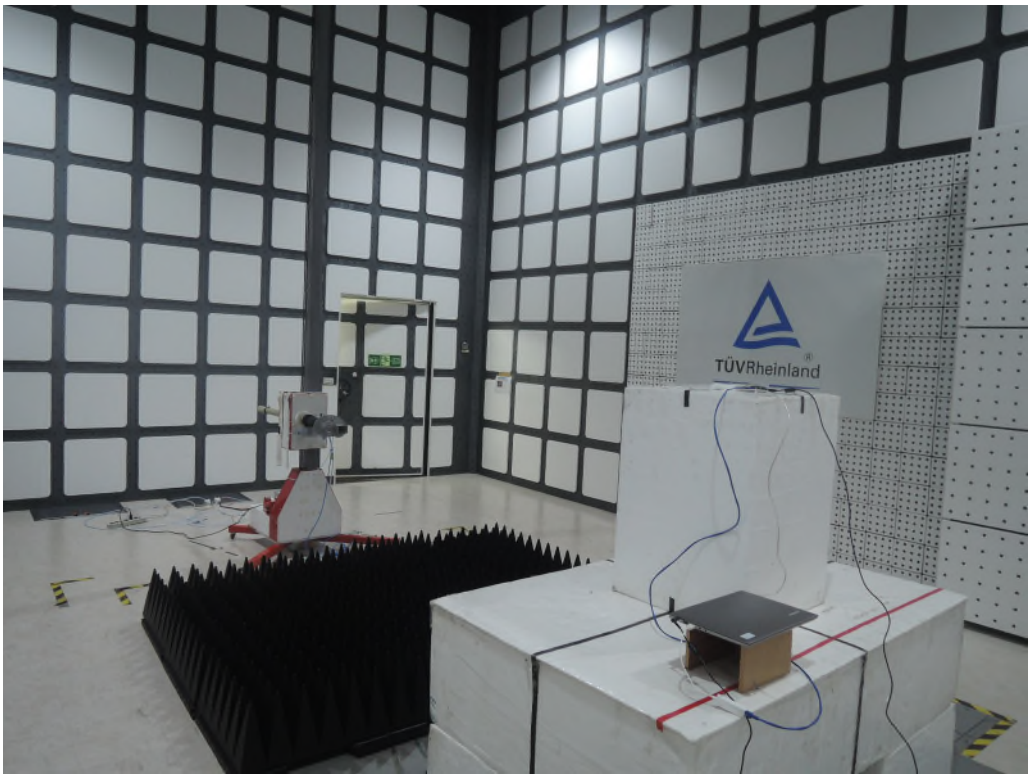
Photograph 3: Set-up for Spurious Emissions (Back View 2)



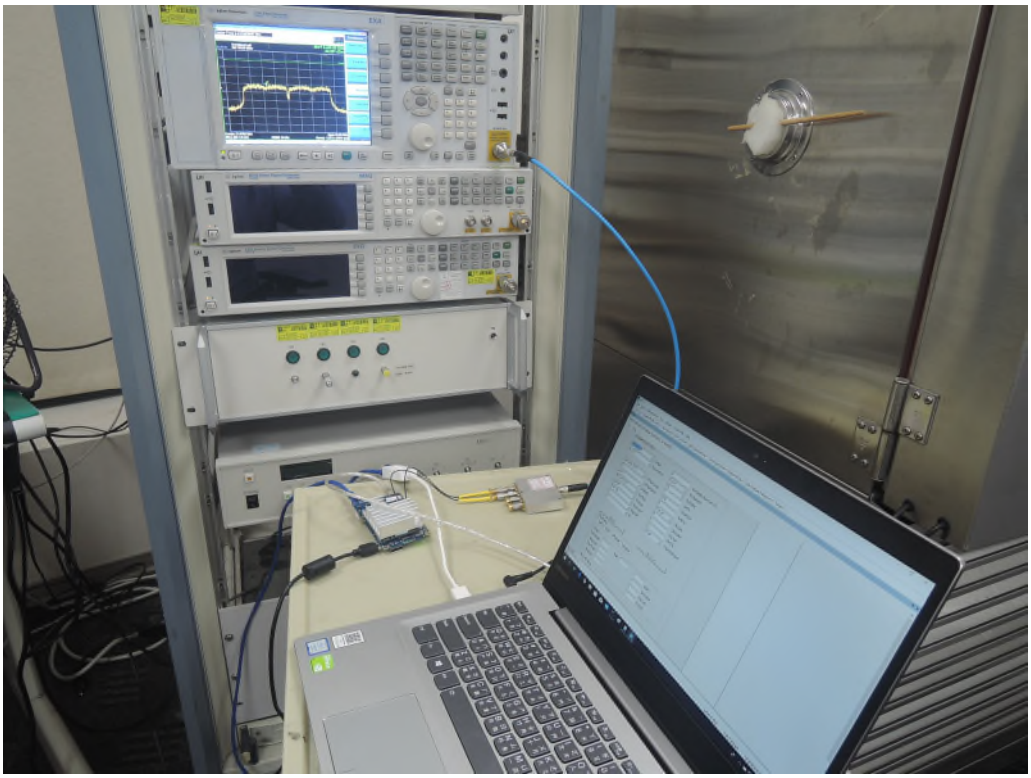
Photograph 4: Set-up for Spurious Emissions (Back View 3)



Photograph 5: Set-up for Spurious Emissions (Back View 4)

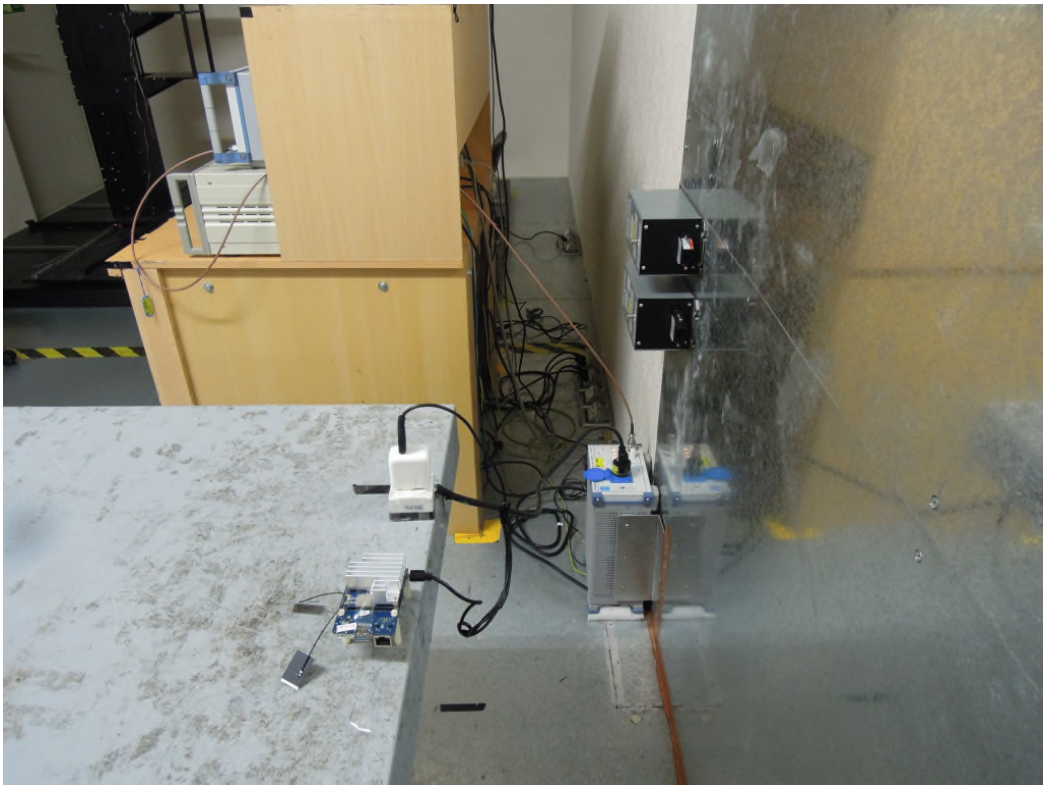


Photograph 6: Set-up for Conducted test



Photograph 7: Set-up for Mains Conducted testing (Front View)

Photograph 8: Set-up for Mains Conducted testing (Back View)



7. List of Tables

8. List of Photographs