



FCC RADIO TEST REPORT

FCC ID : A4RGUIK2
Equipment : Interactive Device
Model Name : GUIK2
Applicant : Google LLC
1600 Amphitheatre Parkway,
Mountain View, California, 94043 USA
Standard : FCC 47 CFR Part 15.255
DA-18-1308

The product was received on May 28, 2020 and testing was started from May 30, 2020 and completed on Jul. 15, 2020. We, SPORTON INTERNATIONAL INC., EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures ANSI C63.10-2013 and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Louis Wu

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



Table of Contents

History of this test report.....	3
Summary of Test Result.....	4
1 General Description	5
1.1 Feature of Equipment Under Test.....	5
1.2 Product Specification of Equipment Under Test	5
1.3 Modification of EUT	5
1.4 Testing Location	6
1.5 Applied Standards	6
2 Test Configuration of Equipment Under Test	7
2.1 Test Mode.....	7
2.2 Connection Diagram of Test System	7
2.3 Far Field Condition for Frequency above 18GHz.....	7
3 Radiated Test Items	8
3.1 Measuring Instruments.....	8
3.2 Test Setup	8
3.3 Test Result of Radiated Test.....	9
3.4 Duty Cycle	10
3.5 Emission Bandwidth	11
3.6 EIRP Power Measurement.....	13
3.7 Peak Power Spectral Density Measurement.....	15
3.8 Transmit Spurious Emission.....	17
3.9 Frequency Stability	29
4 AC conducted Emission Measurement	30
4.1 Limit of AC Conducted Emission.....	30
4.2 Measuring Instruments.....	30
4.3 Test Procedures	30
4.4 Test Setup	31
4.5 Test Result of AC Conducted Emission	32
5 List of Measuring Equipment.....	34
6 Uncertainty of Evaluation	37



History of this test report

Report No.	Version	Description	Issued Date
FR052022	01	Initial issue of report	Jun. 29, 2020
FR052022	02	Add test result of frequency stability	Jul. 15. 2020

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Limit	Result (PASS/FAIL)	Remark
3.4	DA-18-1308	Duty Cycle	10% within 33ms	Pass	-
3.5	DA-18-1308 §15.255(e)	Emission Bandwidth	20dB bandwidth Within 57 ~ 64GHz	Pass	-
3.6	DA-18-1308	EIRP Power	Peak < 13dBm	Pass	-
3.7	DA-18-1308	Peak PSD	13 dBm/MHz	Pass	-
3.8	§15.255(d)	Transmitter Spurious Emissions	§15.255(d)	Pass	-
3.9	DA-18-1308 §15.255(f)	Frequency Stability for Temperature & Voltage	Within 57GHz-64GHz	Pass	-
4	§15.207	AC Power Conducted Emission	§15.207	Pass	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	Interactive Device
Model Name	GUIK2
FCC ID	A4RGUIK2
EUT supports Radios application	WiFi/BT/BLE/15.4Thread/60GHz FMCW

Remark: The above EUT's information was declared by manufacturer.

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Frequency Range	58 - 63.5GHz
Antenna Info	Gain : 5dBi
Type of Modulation	FMCW

1.3 Modification of EUT

No modifications are made to the EUT during all test items.

1.4 Testing Location

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sporton Site No.
	CO05-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No.
	03CH11-HY, 03CH12-HY, 03CH18-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW0007

1.5 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC 47 CFR Part 2, 15.255
- ♦ ANSI C63.10-2013
- ♦ DA-18-1308

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.
3. The DA-18-1308 (is out of TAF accreditation) FCC waiver prohibition have exemptions below:
 - a) Maximum transmit duty cycle 10 percent in any 33 milliseconds (ms) interval, and
 - b) Peak transmitter conducted output power : +10 dBm , peak EIRP power : +13 dBm, and
 - c) Peak power spectral density (PSD) : +13 dBm/MHz and
 - d) Permitted operational frequency range is 57 ~ 64GHz

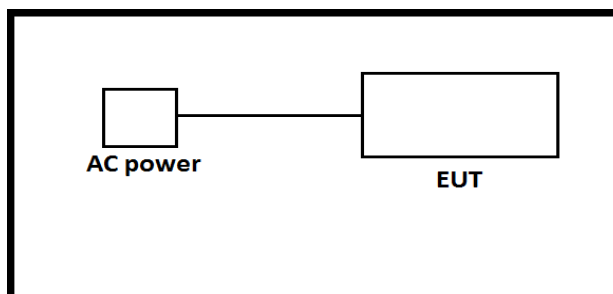
2 Test Configuration of Equipment Under Test

2.1 Test Mode

For radiated measurement, below test modes are performed, three orthogonal plans are verified, and the flatbed (standup) mode is the worst position. The mode 1 follows the FCC 15.31(c) and the mode2 is actual operation mode and only the worst result is placed in test report. During test, the WiFi are enabled for simultaneously transmission.

Test Configuration		
Mode 1	CW	60. 5GHz
Mode 2	FMCW	58GHz ~ 63.5GHz

2.2 Connection Diagram of Test System



2.3 Far Field Condition for Frequency above 18GHz

Horn Antenna	Frequency (GHz)	Antenna Dimension A (mm)	Wavelength (λ) (m)	Far field R (m) $\geq 2A^2 / \lambda$	Measurement Distance (D) (m)	Distance Factor $20\log(D)$ (dB)
BBHA 9170	18	60	0.0167	0.43	1	0.00
	40	60	0.0075	0.96		
QWH-UPRR00	40	48	0.0075	0.61	0.87	-1.21
	57	48	0.0053	0.87		
QWH-VPRR00	57	38	0.0053	0.54	0.62	-4.15
	65	38	0.0046	0.62		
QWH-EPRR00	60	31	0.0050	0.38	0.6	-4.44
	90	31	0.0033	0.6		
QWH-FPRR00	90	21	0.0033	0.26	0.42	-7.54
	140	21	0.0021	0.42		
QWH-GPRR00	140	14	0.0021	0.18	0.26	-11.7
	200	14	0.0015	0.26		

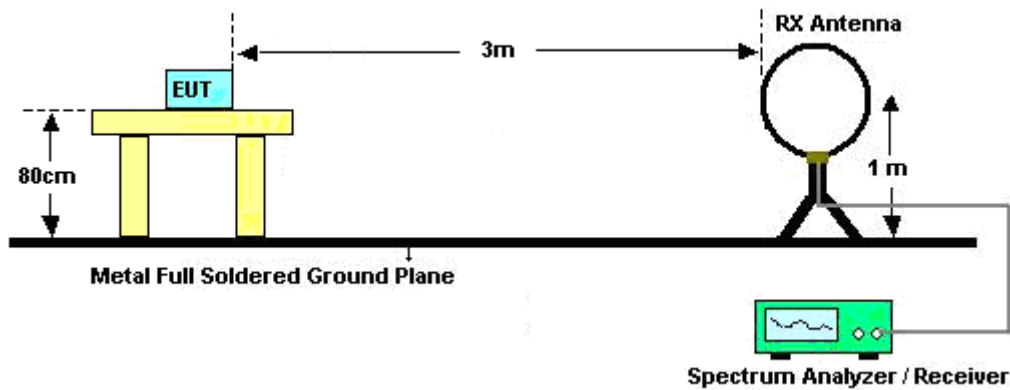
3 Radiated Test Items

3.1 Measuring Instruments

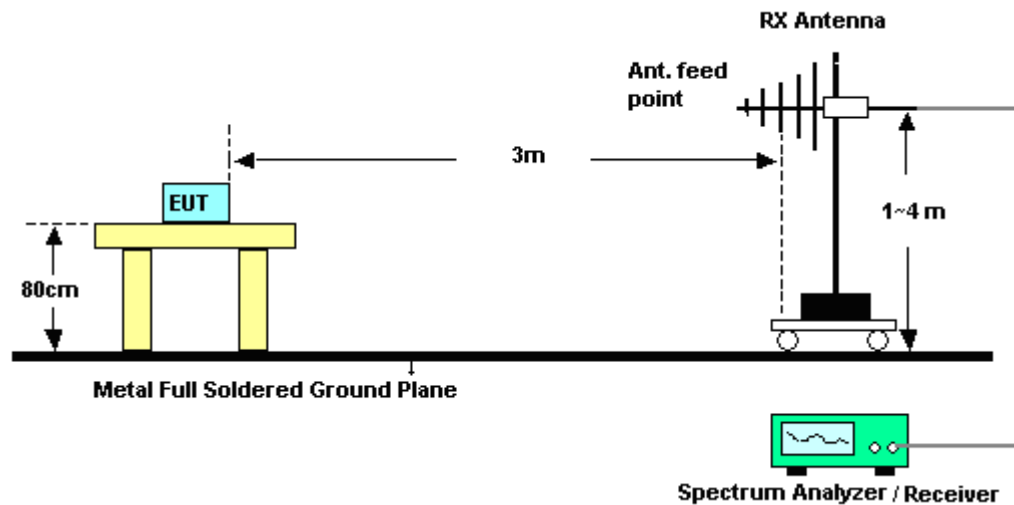
See list of measuring instruments of this test report.

3.2 Test Setup

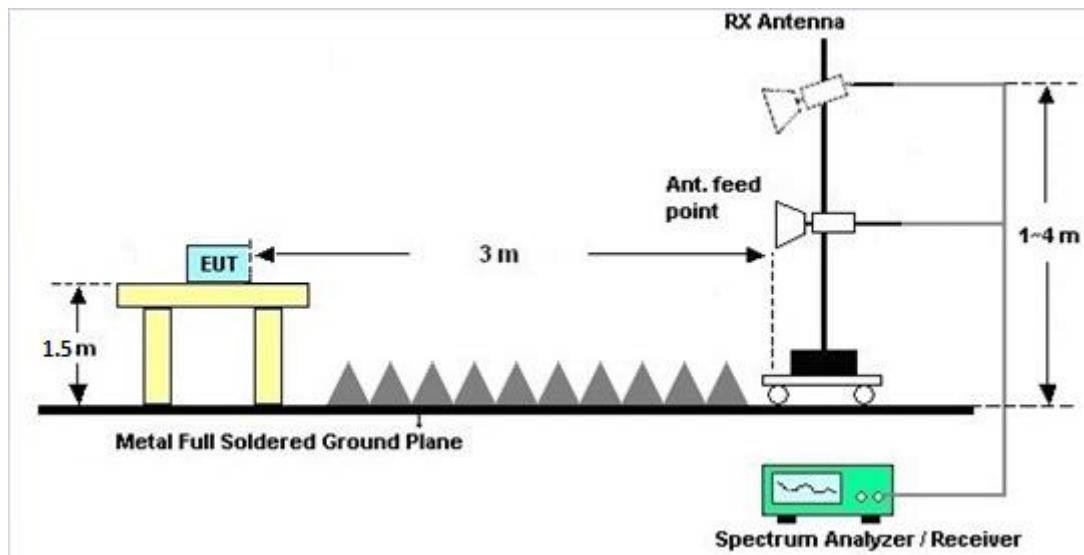
For radiated emissions from 9kHz to 30MHz



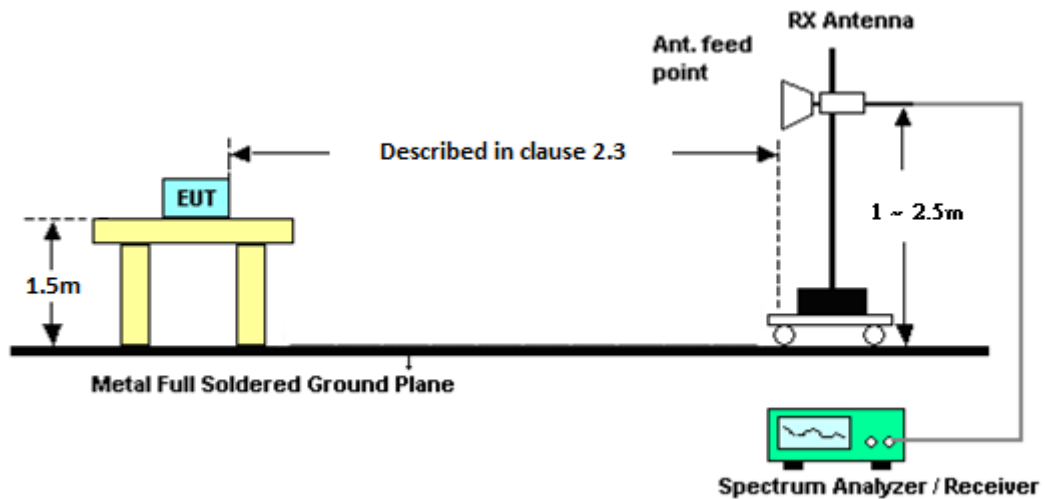
For radiated emissions from 30MHz to 1GHz



For radiated emissions 1GHz to 18GHz



For radiated emissions above 18GHz



3.3 Test Result of Radiated Test

Please refer to Clause 3.8.

3.4 Duty Cycle

3.4.1 Description of Duty Cycle Measurement

Per paragraph 14 of the associated waiver, FCC DA 18-1308, the device shall operate with a maximum transmit duty cycle of 10 percent in any 33 milliseconds (ms) interval.

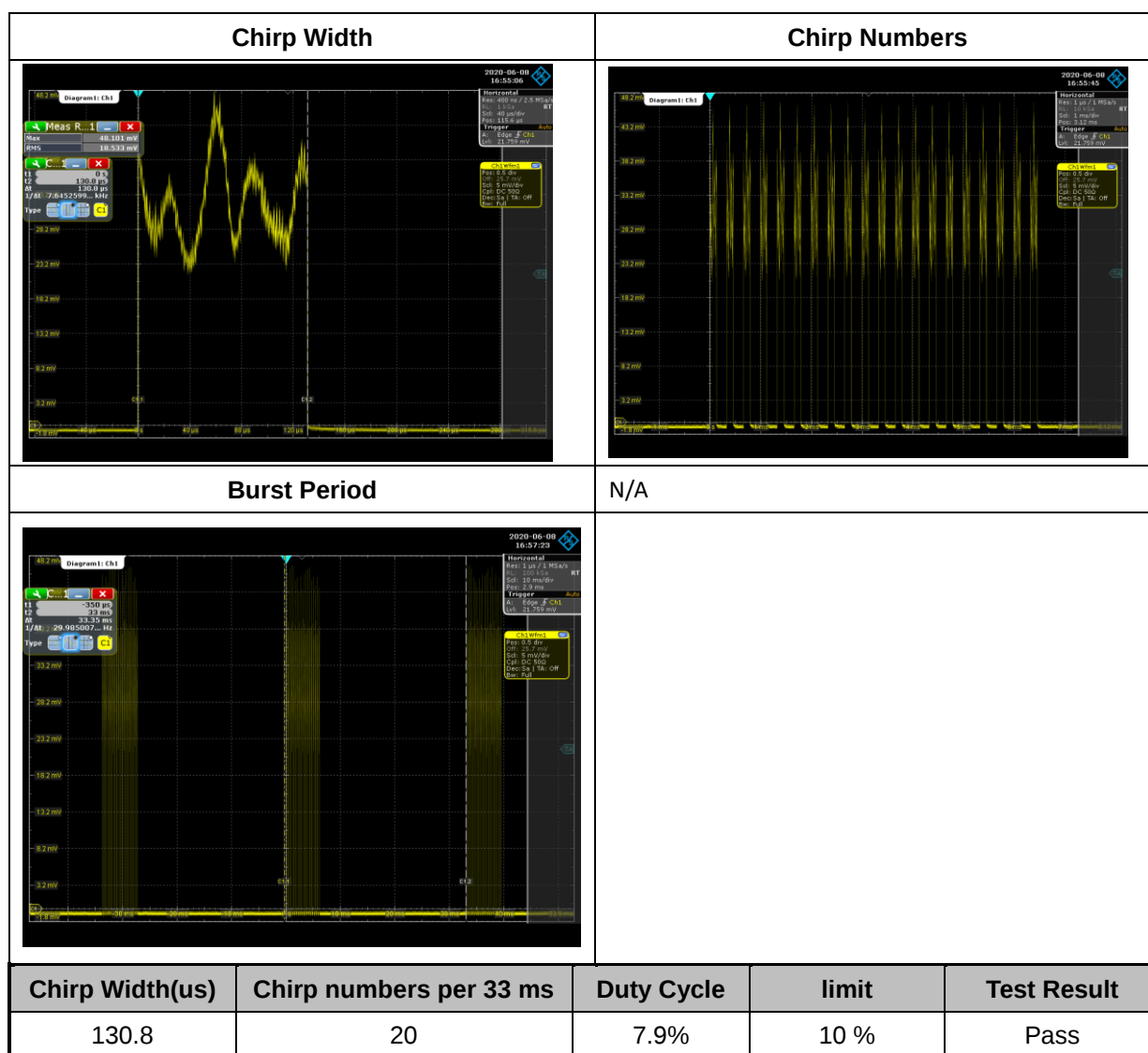
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

The testing follows ANSI C63.10-2013 Section 9.11

3.4.4 Test Results





3.5 Emission Bandwidth

3.5.1 Description of Emission Bandwidth Measurement

99% OBW is for reporting only.

Limit for 20 dB Bandwidth: Per paragraph 14 of the associated waiver, FCC DA 18-1308, the device shall operate in the 57 - 64 GHz band.

The emission bandwidth (EBW) is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least the specified amount below the maximum level of the modulated carrier.

3.5.2 Measuring Instruments

See list of measuring equipment of this test report.

3.5.3 Test Procedures

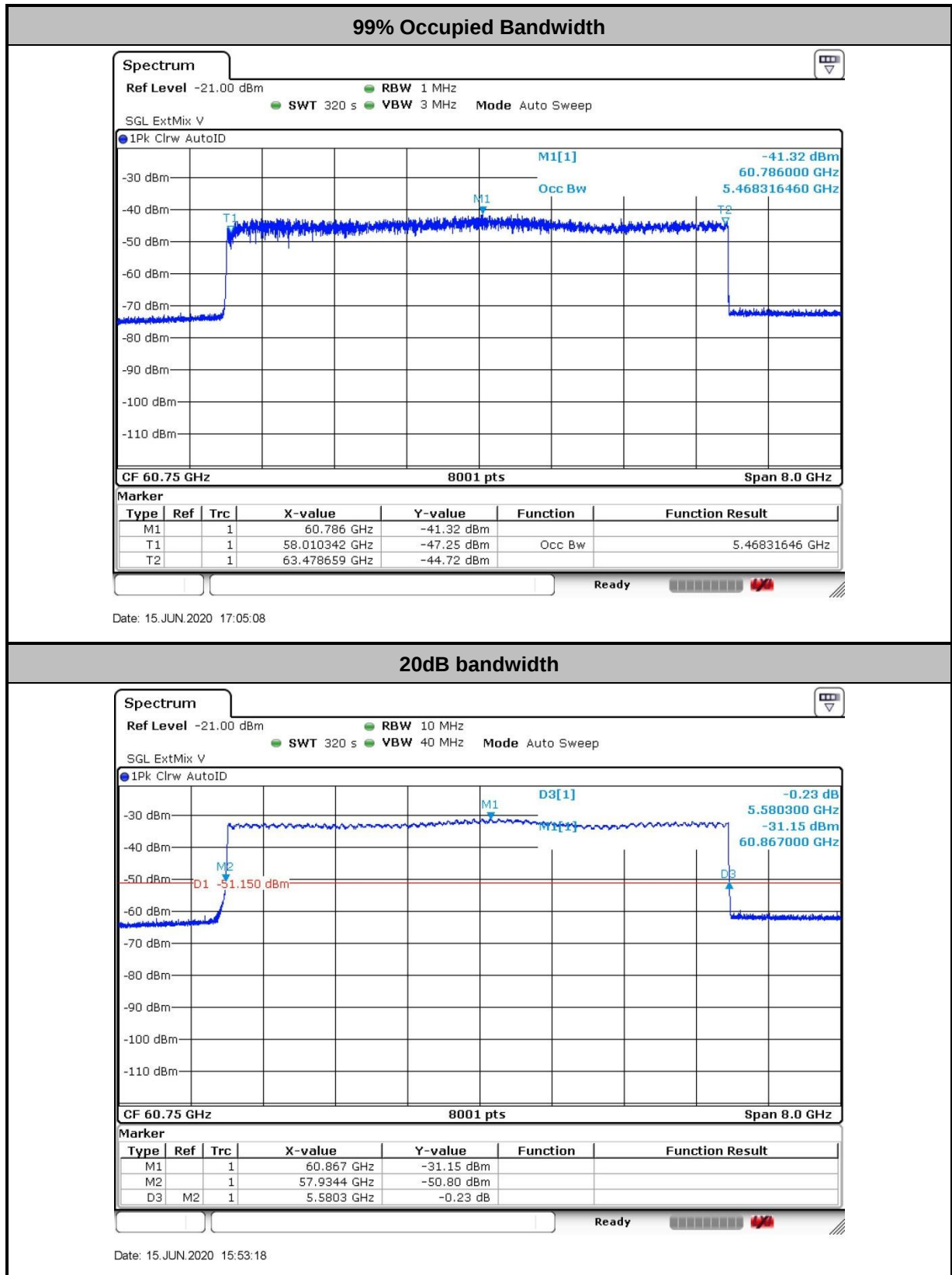
The testing follows ANSI C63.10-2013 Section 9.3 and 9.14.

3.5.4 Test Results

Temperature	21 ~ 25℃	Relative Humidity	58 ~ 65%
Test Engineer	Steve Chen		
99% Occupied Bandwidth (GHz)		Limit (GHz)	
5.4683		Report Only	
20dB Bandwidth Measurement			
Bandwidth (GHz)	Low Frequency (GHz)	High Frequency (GHz)	Result
5.5803	57.9344	63.5147	Pass



3.5.5 Test Plots



3.6 EIRP Power Measurement

3.6.1 Test Limit

Regulation	Product Type	Peak EIRP Power (dBm)	Peak Conducted power (dBm)
FCC 15.255 (c) (3)	Short-range devices for interactive motion sensing	13	10

Note: According to the FCC DA-18-1308 waiver, the Peak EIRP allows to be 13dBm instead of the 10dBm Peak EIRP limit and the Peak Conducted Power is allowed to be 10dBm instead of the -10dBm Peak Conducted Power limit in the FCC 15.255 (c)(3).

3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013 clause 9.5 and 9.11

3.6.4 Test Results

Temperature		21 ~ 25℃		Relative Humidity		58 ~ 70%		
Test Engineer		Steve Chen						
EIRP Power Measurement								
Frequency (GHz)	Measure Dist. (m)	Measure Ant Gain (dBi)	DSO (mV)	Power measured (dBm)	Emeas (dBuV/m)	EIRP (dBm)	EIRP Limit (dBm) Peak	Result
60.79	0.62	23.3	48.1	-27.92	121.68	12.86	13	PASS

Peak Conducted Power Measurement					
Frequency (GHz)	Peak EIRP (dBm)	Antenna gain(dBi)	Conducted power (dBm)	Limit (dBm)	Result
60.79	12.86	5	7.86	10	PASS

For radiated emissions, calculate the field strength (E) in dBμV/meter.

$$E = 126.8 - 20\log(\lambda) + P - G$$

where:

E : is the field strength of the emission at the measurement distance, in dBμV/m

P : is the power measured at the output of the test antenna, in dBm

λ: is the wavelength of the emission under investigation [300/fMHz], in m

G : is the gain of the test antenna, in dBi For radiated emissions, calculate the EIRP (dBm). If the measurement was performed in the far field, calculate the EIRP.

$$EIRP = E\text{-meas} + 20\log(d\text{-meas}) - 104.7$$

where:

EIRP : is the equivalent isotopically radiated power, in dBm

E-meas. : is the field strength of the emission at the measurement distance, in dBμV/m

d-meas. : is the measurement distance, in m

NOTE 1: The comparison method which replaces EUT with a signal generator is used to find the correct conversion factor between “DSO(mV)” & “Power Measured(dBm)”.

NOTE 2: Conducted Power (dBm) = EIRP (dBm) - antenna gain (dBi)

Calculation example:

$$E(\text{dBuV/m}) = 126.8 - 20\log(\lambda) + P - G, \text{ where } f=60\text{GHz}, P= -10\text{dBm}, G= 24\text{dBi}, \text{ then } E = 138.8 (\text{dBuV/m})$$

$$EIRP (\text{dBm}) = E(\text{dBuV/m}) + 20\log(d) - 104.7 = 138.8 (\text{dBuV/m}) + 20\log(d=1) - 104.7 = 31.4\text{dBm}$$



3.7 Peak Power Spectral Density Measurement

3.7.1 Limit of Peak Power Spectral Density

Peak Power Spectral Density Limit
13 dBm/MHz*
* For the applicable limit, see FCC DA-18-1308 waiver.

3.7.2 Measuring Instruments

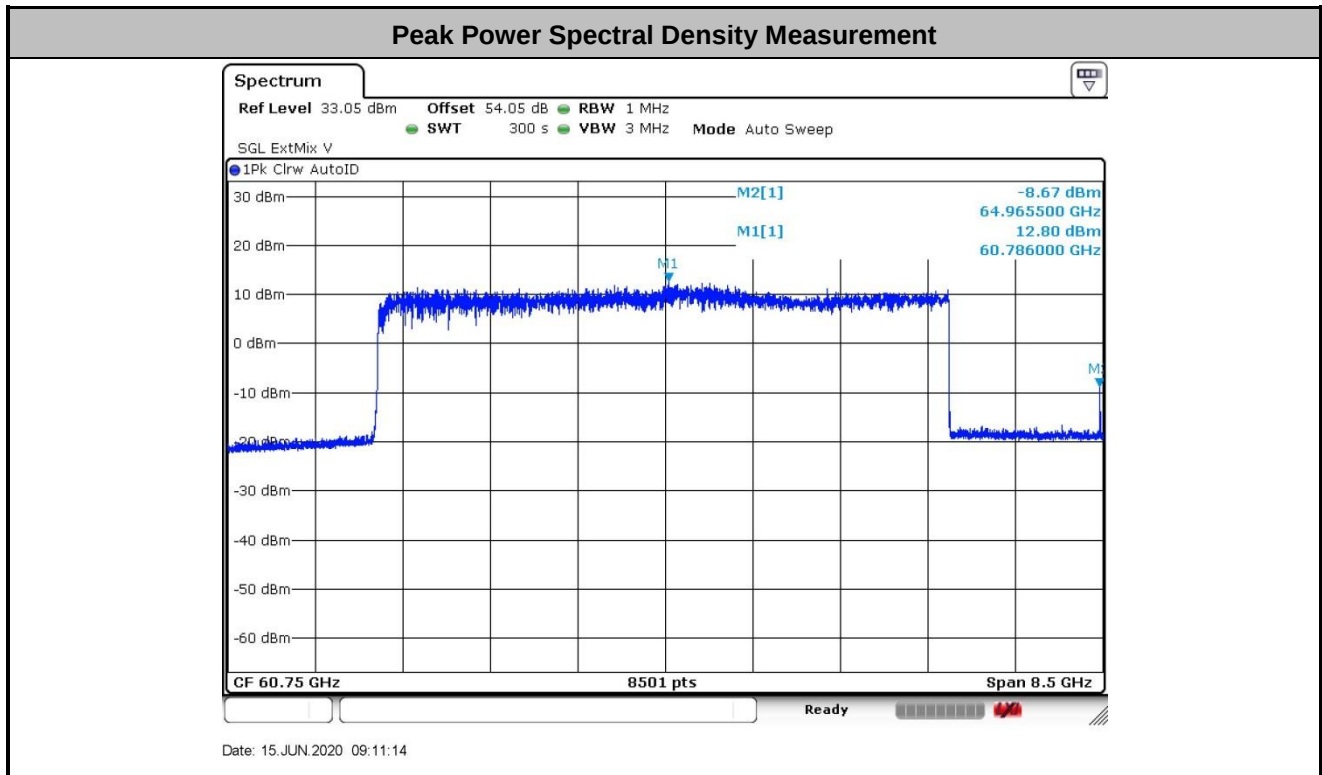
See list of measuring equipment of this test report.

3.7.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013 clause 9.10 and Annex G

3.7.4 Test Result

Temperature	21 ~ 25°C	Relative Humidity	58 ~ 65%
Test Engineer	Steve Chen		
Max. Peak PSD (dBm/MHz)	Peak PSD Limit (dBm/MHz)	Result	
12.80	13	PASS	



Note: Marker 2 is an image signal.

1. The spectrum offset value has included total path loss, antenna gain and desensitization factor into the

spectrum analyser

Frequency (F) (MHz)	Ant Gain (dBi)	IF cable loss (dB)	d (m)	Desensitization Factor (dB)	Free space loss (dB)	Offset (dB)
60750	23.3	0.7	0.62	12.69	63.96	54.05

Note1: Offset=Free space loss – Ant. Gain + Cable Loss + Desensitization factor

Note2: The Mixer conversion loss has been offset in mixer mode of spectrum analyser.

Note3: The free-space propagation path loss is determined from Equation (G.9) of Annex G in ANSI C63.10
 $= 20\log F + 20\log(d) - 27.5.$

2. The FMCW Desensitization factor

Start Freq (GHz)	Stop Freq (GHz)	FMCW Width (MHz)	Ramp Time (us)	Sweep Rate (Hz/s)	RBW (Hz)	Normalized Sweep Rate (lin)	Desensitization factor (lin)	Desensitization factor (dB)
58	63.5	5500	130.8	4.20E+13	1.00E+06	42.05	0.23	-12.69

Note: the derivation of the FMCW Desensitization Factor is given in Keysight Application Note 5925 – 1039 Appendix B.

$$\alpha = \frac{1}{\sqrt[4]{1 + \left(\frac{2\ln(2)}{\pi}\right)^2 \left(\frac{F_S}{T_S B^2}\right)^2}}$$

and

FMCW Desensitization Factor = 20 Log(α), Where:

FS = FMCW Sweep width or chirp Width

TS = FMCW Sweep Time

B = 3-dB bandwidth of Gaussian RBW Filter

3.8 Transmit Spurious Emission

3.8.1 Limit of Radiated Spurious Emission

Frequency Range	Limit
Below 40GHz	Follow 15.209
Above 40GHz	90 pW/cm ² @ 3m (equivalent EIRP 102uW, -10dBm)
Note1: For the applicable limit, see FCC 15.255 (d)	
Note2: Spurious emissions shall not exceed the level of fundamental emission.	

3.8.2 Measuring Instruments

See list of measuring equipment of this test report.

3.8.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013, clause 9.12 and 9.13.

For above 40GHz emission:

$$\text{EIRP} = \text{Prx} - \text{Grx} + \text{Free space loss} = \text{Prx} - \text{Grx} + 20\log(4\pi d/\lambda)^2$$

Which

Prx = Read Level

Grx = Rx Antenna Gain

A distance factor is offset and formula is $20\log(D1/D2)$

Which

D1 = Specification distance = 3m

D2 = Measurement distance



3.8.4 Test Result

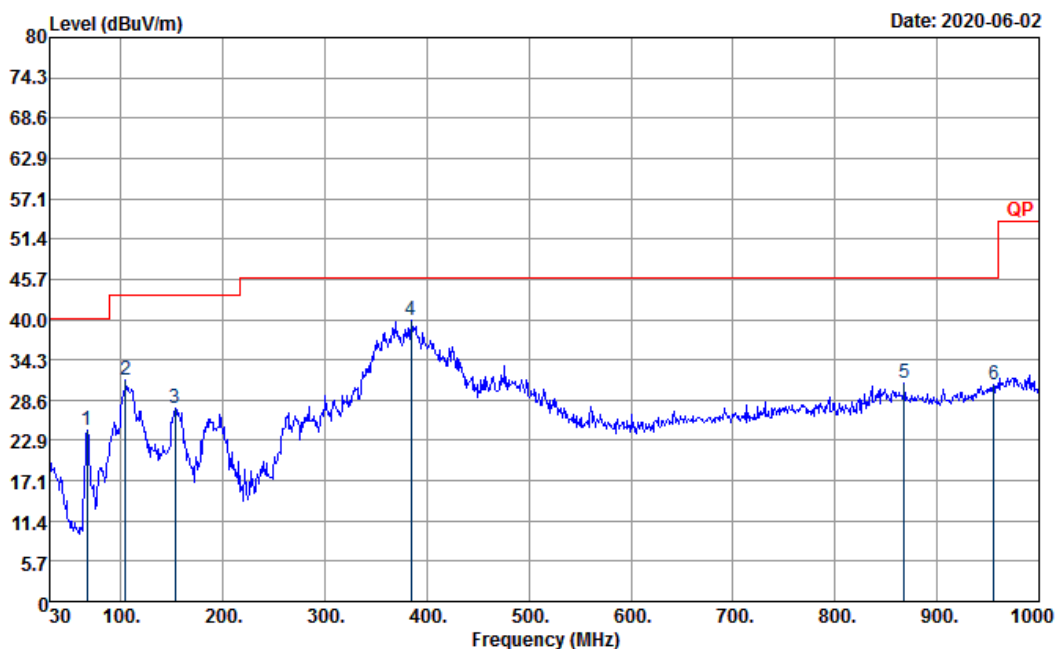
3.8.5 Below 30MHz

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported. The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10 harmonic or 40 GHz, whichever is appropriate.

3.8.6 30MHz to 1GHz

Temperature	21 ~ 25°C	Relative Humidity	55 ~ 65%
Test Engineer	Cookie Gu	Test Distance	3m
Test Range	30MHz to 1GHz	Test Configuration	CW

Horizontal

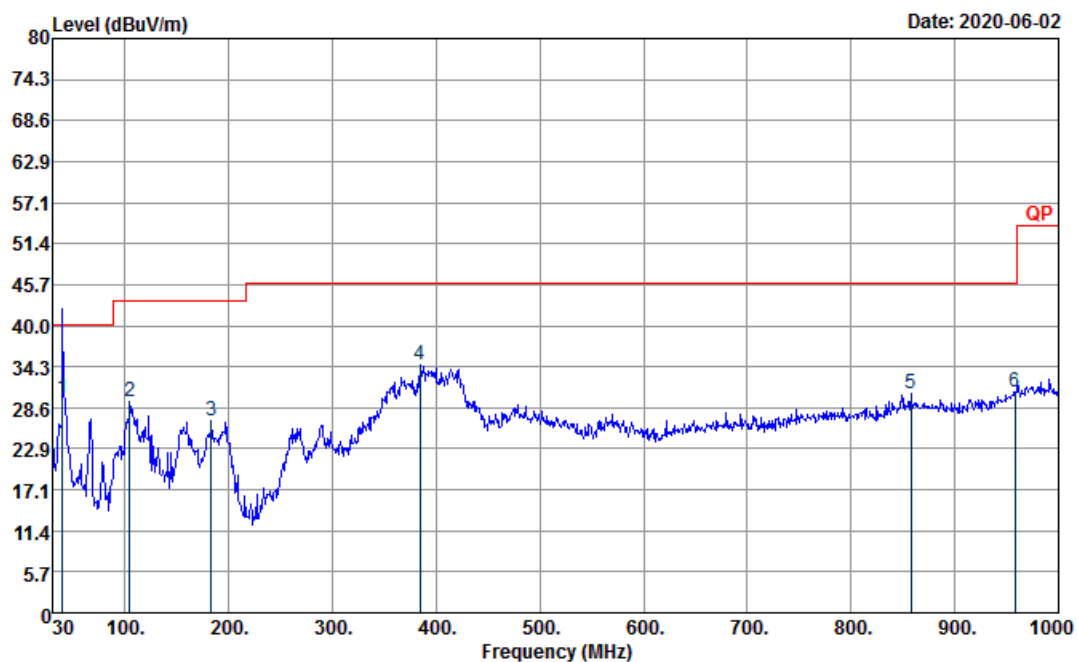


Site : 03CH11-HY
Condition : QP 3m BI-LOG 6111D-LF_ETC HORIZONTAL
Detector : Peak
Project : 052022
Plane : Y with Adapter

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	66.86	24.34	-15.66	40.00	43.94	11.71	1.13	32.49	---	---	Peak
2	104.69	31.47	-12.03	43.50	46.11	16.27	1.43	32.39	---	---	Peak
3	153.19	27.37	-16.13	43.50	41.44	16.60	1.73	32.49	---	---	Peak
4	384.05	39.85	-6.15	46.00	48.12	20.86	2.75	31.96	100	0	Peak
5	868.08	30.97	-15.03	46.00	29.55	29.05	4.04	31.87	---	---	Peak
6	955.38	30.64	-15.36	46.00	26.81	30.38	4.23	31.00	---	---	Peak



Vertical



Site : 03CH11-HY
Condition : QP 3m BI-LOG 6111D-LF_ETC VERTICAL
Detector : Peak
Project : 052022
Plane : Y with Adapter

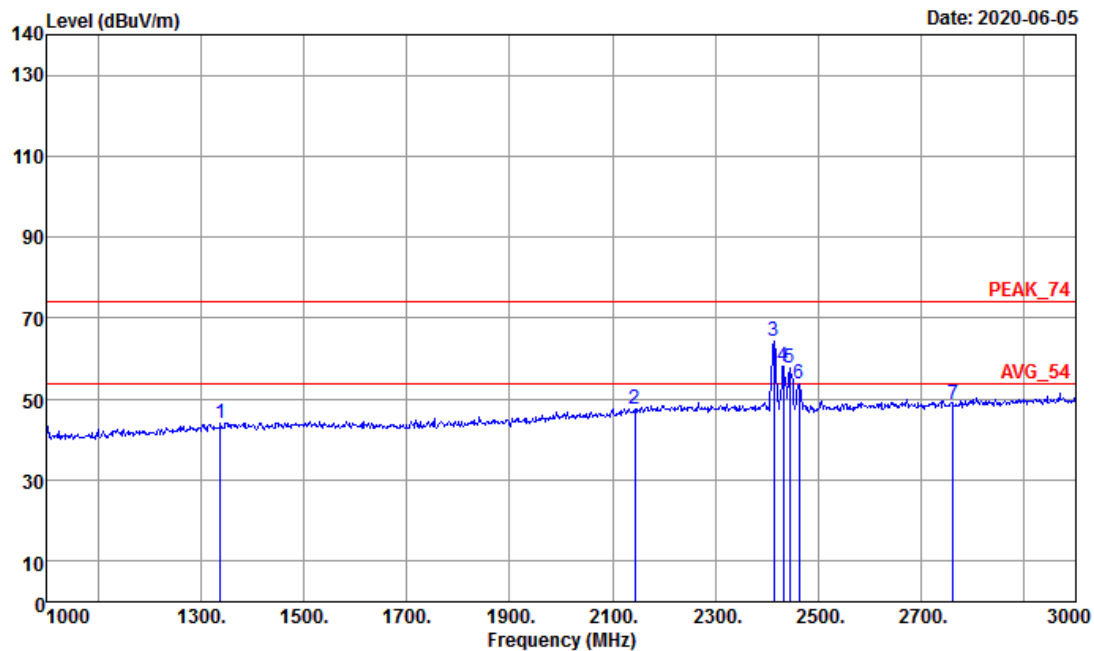
	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	39.70	29.85	-10.15	40.00	42.02	19.40	0.89	32.48	100	29	QP
2	104.69	29.32	-14.18	43.50	43.96	16.27	1.43	32.39	---	---	Peak
3	183.26	26.74	-16.76	43.50	42.67	14.61	1.88	32.55	---	---	Peak
4	384.05	34.45	-11.55	46.00	42.72	20.86	2.75	31.96	---	---	Peak
5	857.41	30.52	-15.48	46.00	29.26	28.95	4.02	31.91	---	---	Peak
6	958.29	30.84	-15.16	46.00	26.78	30.57	4.23	30.96	---	---	Peak



3.8.7 1GHz to 18GHz

Temperature	22 ~ 24℃	Relative Humidity	55 ~ 65%
Test Engineer	Jack Cheng	Test Distance	3m
Test Range	1GHz to 18GHz	Test Configuration	CW

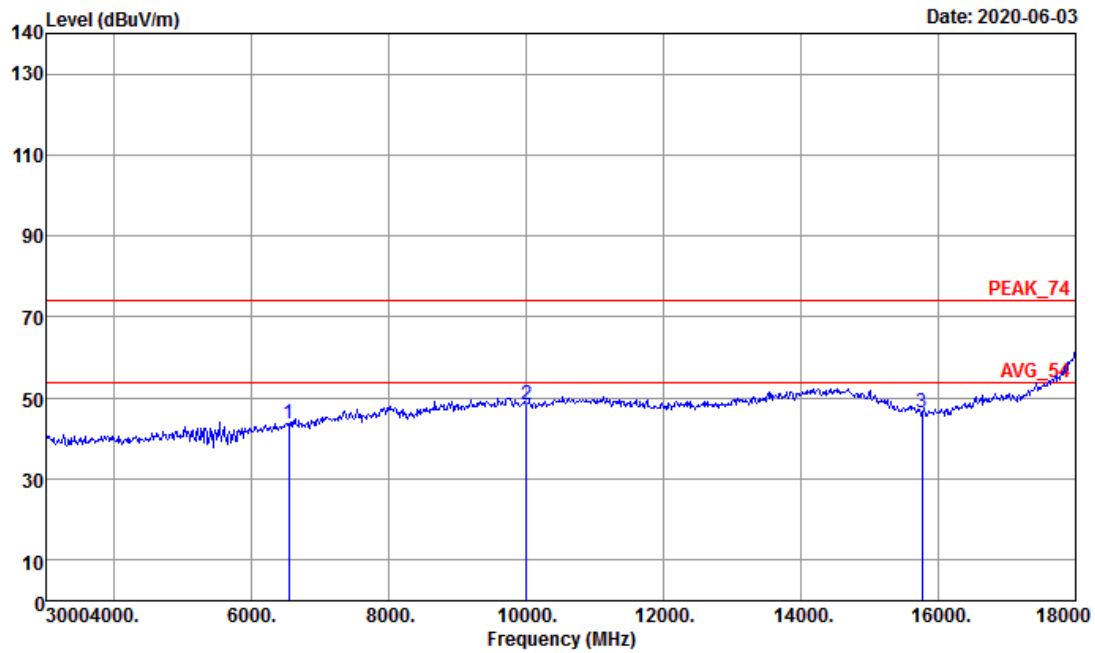
Horizontal



Site : 03CH12-HY
Condition : PEAK_74 3m HORN_9120D_1328 HORIZONTAL
Detector : Peak
Project : 052022
: CW

Mark : 3.4.5.6 is 2.4G WLAN

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamplifier	Pol/Phase	Aux Factor
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		dB
1	1338.00	44.24	-29.76	74.00	44.53	25.88	4.05	30.62	HORIZONTAL	0.40
2	2144.00	47.43	-26.57	74.00	43.53	27.42	5.42	29.35	HORIZONTAL	0.41
3	2414.00	64.51	-9.49	74.00	60.05	27.47	5.86	29.27	HORIZONTAL	0.40
4	2432.00	58.08	-15.92	74.00	53.63	27.44	5.88	29.27	HORIZONTAL	0.40
5	2444.00	57.68	-16.32	74.00	53.24	27.41	5.90	29.27	HORIZONTAL	0.40
6	2462.00	53.86	-20.14	74.00	49.42	27.38	5.92	29.26	HORIZONTAL	0.40
7	2762.00	48.67	-25.33	74.00	43.32	27.77	6.30	29.21	HORIZONTAL	0.49

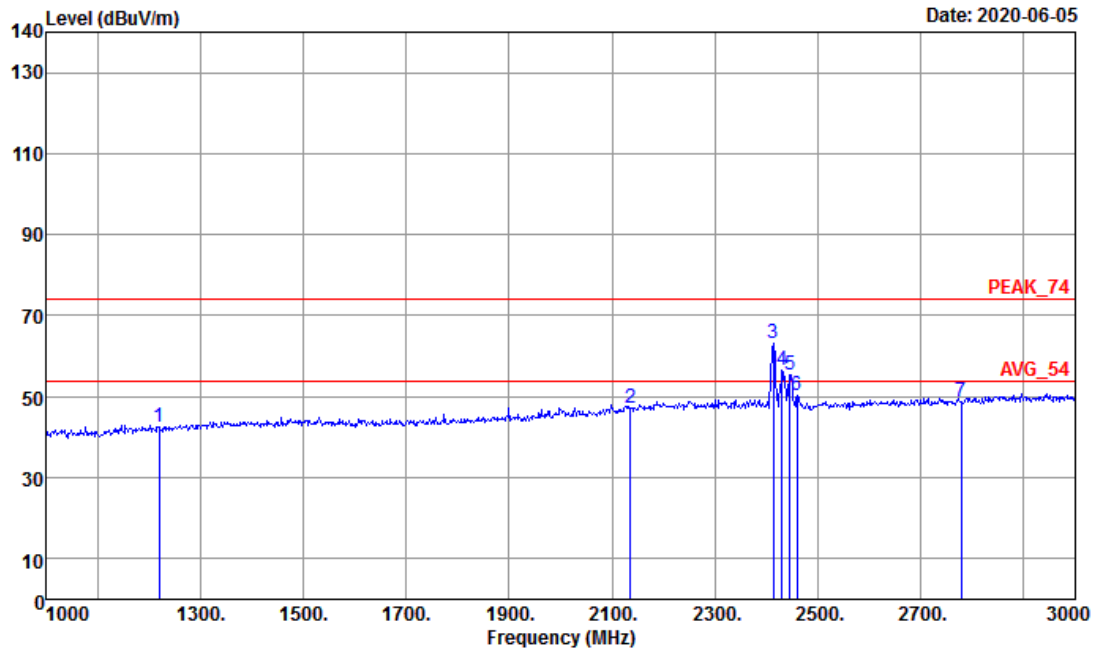


Site : 03CH12-HY
Condition : PEAK_74 3m HORN_9120D_1328 HORIZONTAL
Detector : Peak
Project : 052022
: 36 Filter + 56 NOTCH
: CW

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp		Aux
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Factor
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	dB
1	6540.00	43.55	-30.45	74.00	57.53	34.18	11.26	59.85	0.43
2	10005.00	48.44	-25.56	74.00	54.91	39.10	15.50	61.51	0.44
3	15765.00	46.26	-27.74	74.00	49.31	37.44	19.16	60.28	0.63
4	18000.00	62.99	-11.01	74.00	47.35	50.10	21.56	56.70	0.68
5	18000.00	48.87	-5.13	54.00	33.23	50.10	21.56	56.70	0.68



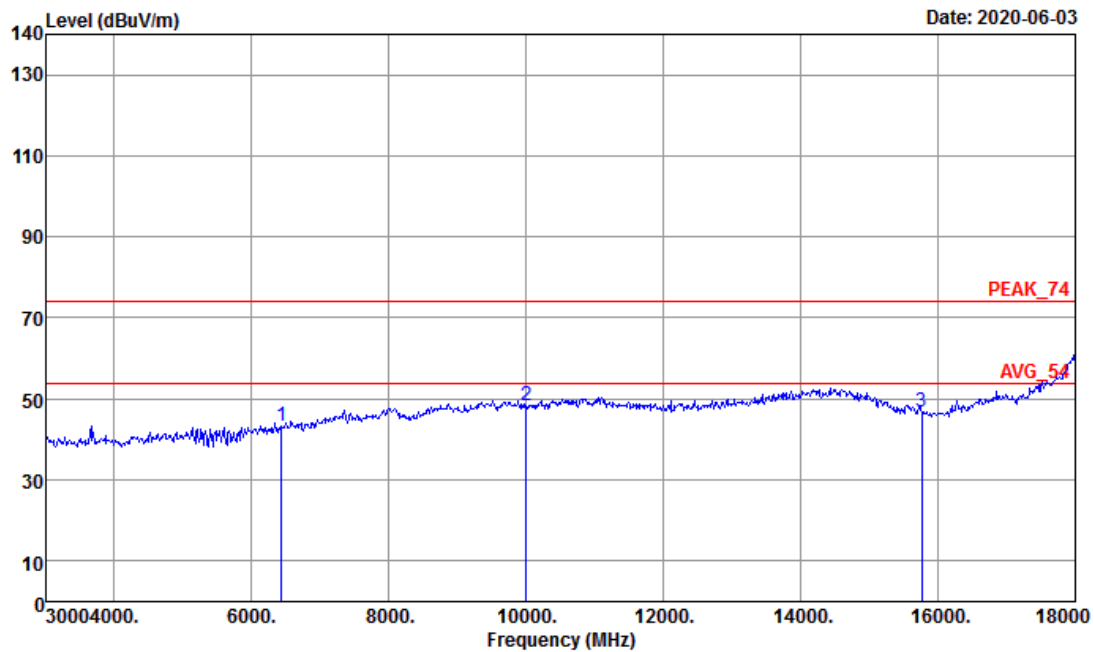
Vertical



Site : 03CH12-HY
Condition : PEAK_74 3m HORN_9120D_1328 VERTICAL
Detector : Peak
Project : 052022
 : CW

Mark : 3.4.5.6 is 2.4G WLAN

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Pol/Phase	Aux Factor
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		dB
1	1220.00	42.36	-31.64	74.00	44.16	25.22	3.85	31.10	VERTICAL	0.23
2	2136.00	47.20	-26.80	74.00	43.43	27.30	5.41	29.35	VERTICAL	0.41
3	2414.00	63.18	-10.82	74.00	58.72	27.47	5.86	29.27	VERTICAL	0.40
4	2430.00	56.37	-17.63	74.00	51.92	27.44	5.88	29.27	VERTICAL	0.40
5	2446.00	55.48	-18.52	74.00	51.04	27.41	5.90	29.27	VERTICAL	0.40
6	2460.00	50.23	-23.77	74.00	45.79	27.38	5.92	29.26	VERTICAL	0.40
7	2778.00	48.61	-25.39	74.00	43.13	27.87	6.32	29.21	VERTICAL	0.50



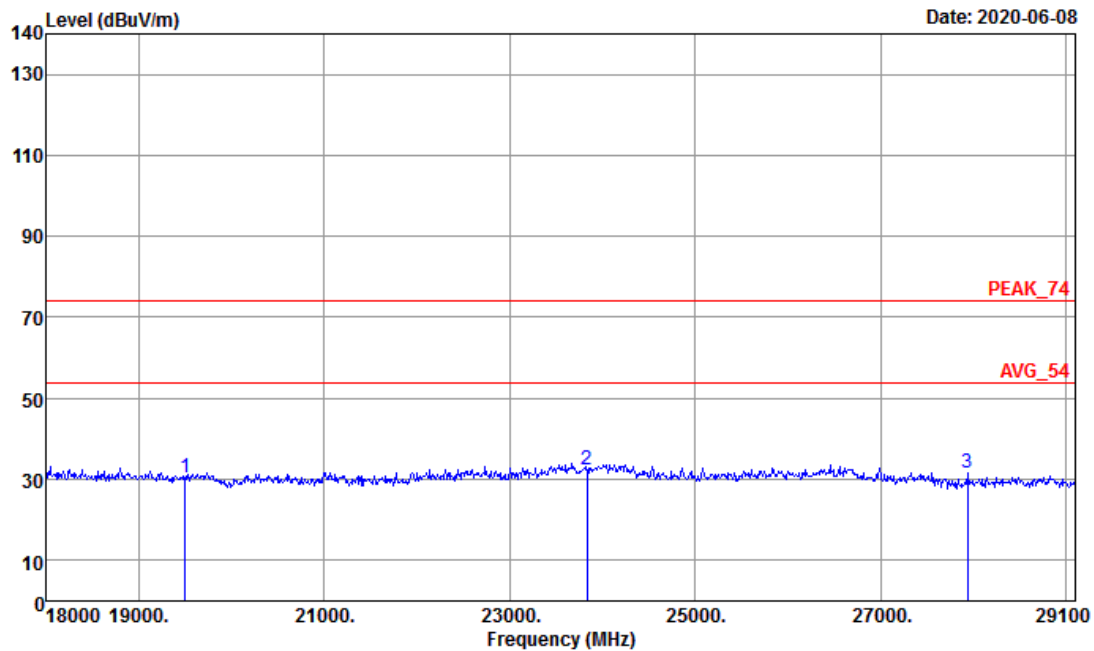
Site : 03CH12-HY
Condition : PEAK_74 3m HORN_9120D_1328 VERTICAL
Detector : Peak
Project : 052022
: 3G Filter + 5G NOTCH
: CW

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp		Aux
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Factor
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	dB
1	6435.00	43.27	-30.73	74.00	57.94	33.74	11.11	59.94	0.42
2	10005.00	48.22	-25.78	74.00	54.69	39.10	15.50	61.51	0.44
3	15765.00	46.97	-27.03	74.00	50.02	37.44	19.16	60.28	0.63
4	18000.00	61.97	-12.03	74.00	46.33	50.10	21.56	56.70	0.68
5	18000.00	49.83	-4.17	54.00	34.19	50.10	21.56	56.70	0.68

**3.8.8 18GHz to 40GHz**

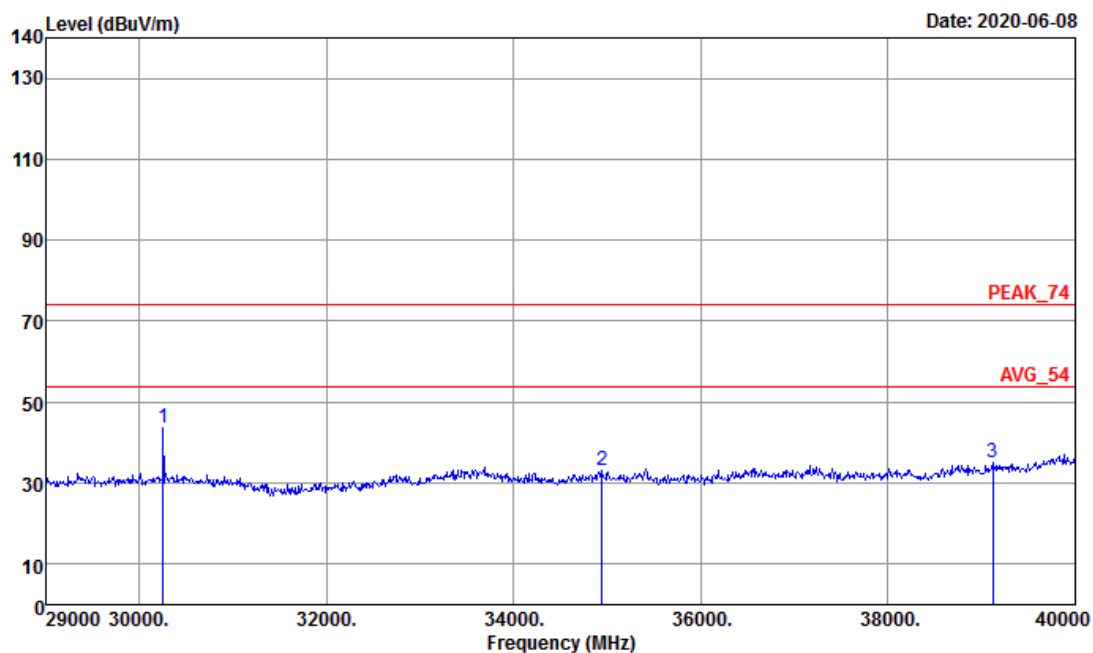
Temperature	22 ~ 24℃	Relative Humidity	55 ~ 65%
Test Engineer	Jack Cheng	Test Distance	1m
Test Range	18GHz to 40GHz	Test Configuration	CW

Horizontal



Site : 03CH12-HY
Condition : PEAK_74 1m SHF HORN BBHA9170584 HORIZONTAL
Detector : Peak
Project : 052022
: CW 60G

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp		Aux
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Factor
			dB	dBuV/m	dBuV	dB/m	dB	dB	dB
1	19498.50	30.42	-43.58	74.00	41.71	37.70	5.11	54.10	HORIZONTAL 0.00
2	23838.60	32.24	-41.76	74.00	39.45	40.17	5.92	53.30	HORIZONTAL 0.00
3	27934.50	31.70	-42.30	74.00	39.70	39.82	6.06	53.88	HORIZONTAL 0.00

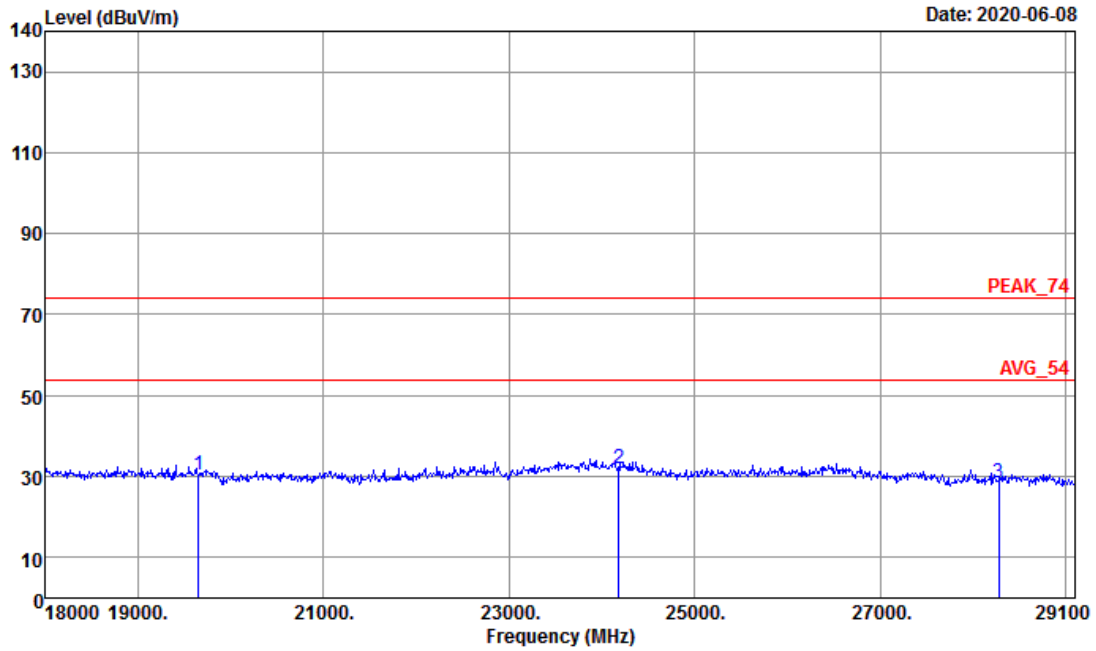


Site : 03CH12-HY
Condition : PEAK_74 1m SHF HORN BBHA9170584 HORIZONTAL
Detector : Peak
Project : 052022
: CW 60G

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Pol/Phase	Aux Factor
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		dB
1	30254.00	43.56	-30.44	74.00	52.14	40.25	6.27	55.10	HORIZONTAL	0.00
2	34940.00	33.22	-40.78	74.00	39.93	42.33	6.85	55.89	HORIZONTAL	0.00
3	39120.00	35.27	-38.73	74.00	39.06	44.22	7.17	55.18	HORIZONTAL	0.00

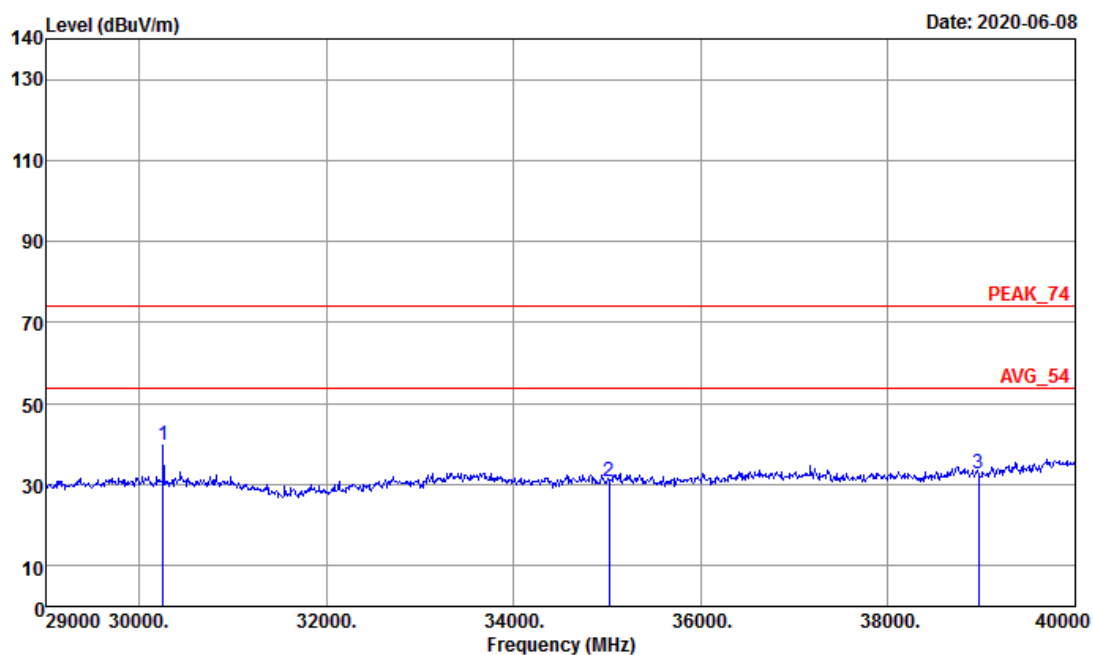


Vertical



Site : 03CH12-HY
Condition : PEAK_74 1m SHF HORN BBHA9170584 VERTICAL
Detector : Peak
Project : 052022
: CW 60G

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Cable Factor	Preamp Loss	Pol/Phase	Aux Factor	
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	dB	
1	19653.90	30.34	-43.66	74.00	41.46	37.73	5.16	54.01	VERTICAL	0.00
2	24182.70	32.00	-42.00	74.00	39.19	40.29	5.89	53.37	VERTICAL	0.00
3	28278.60	28.35	-45.65	74.00	36.40	39.90	6.11	54.06	VERTICAL	0.00



Site : 03CH12-HY
Condition : PEAK_74 1m SHF HORN BBHA9170584 VERTICAL
Detector : Peak
Project : 052022
: CW 60G

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp		Aux
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Factor
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	dB
1	30254.00	39.63	-34.37	74.00	48.21	40.25	6.27	55.10	0.00
2	35017.00	30.79	-43.21	74.00	37.37	42.49	6.84	55.91	0.00
3	38966.00	32.92	-41.08	74.00	37.01	44.00	7.16	55.25	0.00



3.8.9 40GHz to 200GHz

Temperature	21 ~ 25℃	Relative Humidity	58 ~ 65%
Test Engineer	Steve Chen	Test Distance	1
Test Range	40GHz to 200GHz	Test Configuration	CW

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
40 - 57	23.5	0.87	48.54	-84.8
EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Limit (pW/cm ²)	Test Result
-41.6	3	0.061171288	90	PASS

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
64 - 90	23.9	0.6	89.41	-79.31
EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Limit (pW/cm ²)	Test Result
-35.42	3	0.253832733	90	PASS

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
90 - 140	24.4	0.423	135.21	-68.11
EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Limit (pW/cm ²)	Test Result
-24.27	3	3.307863855	90	PASS

Test Frequency (GHz)	Rx Antenna Gain (dBi)	Measurement Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)
140 - 200	23.4	0.264	170.63	-64.63
EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Limit (pW/cm ²)	Test Result
-20.75	3	7.439566438	90	PASS

3.9 Frequency Stability

3.9.1 Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency range, 57GHz – 64GHz.

3.9.2 Measuring Instruments

See list of measuring equipment of this test report.

3.9.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013 clause 9.14

3.9.4 Test Result

Test Engineer	Steve Chen			
Test Conditions	60.5GHz CW mode			Limit
Test Temperature (°C)	Voltage (Volt)	Measured Frequency (MHz)	Delta Frequency (±kHz)	Result
50	120	60498.697	-652	pass
40	120	60498.784	-565	
30	120	60498.928	-421	
20	120	60499.349	0	
10	120	60499.754	405	
0	120	60500.159	810	
-10	120	60500.463	1114	
-20	120	60500.753	1404	
20	102	60499.348	-1	
20	138	60499.350	1	

Note: The frequency stability remains within 57GHz – 64GHz, when the maximum delta frequency deviation takes account into both the lowest and highest frequency points of 20dB bandwidth.

4 AC conducted Emission Measurement

4.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

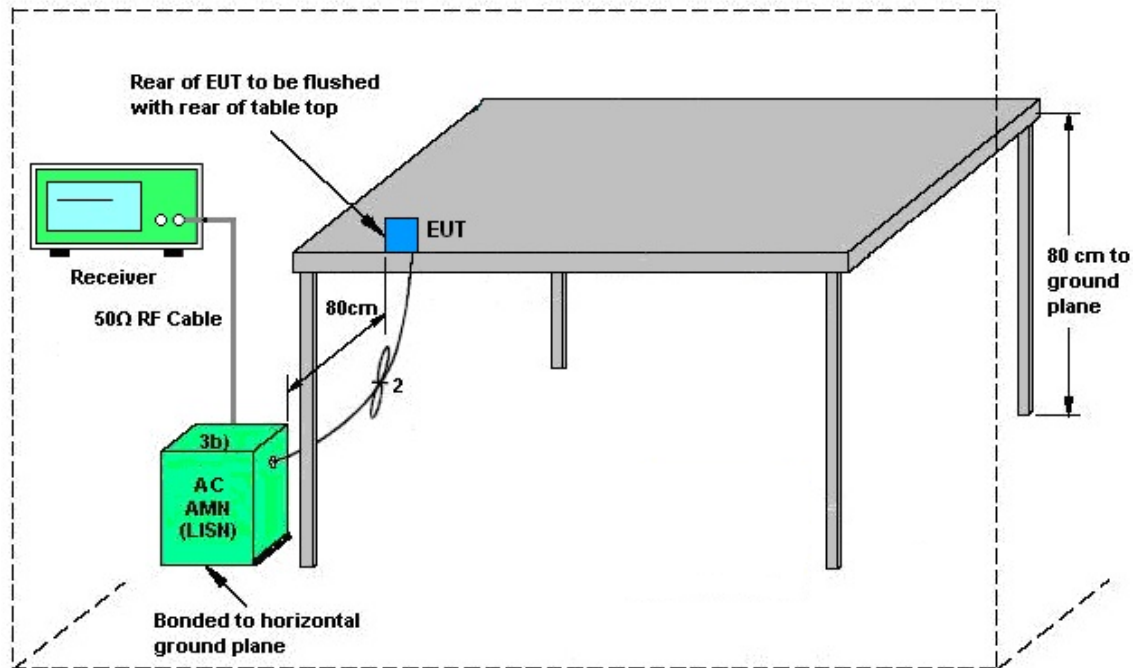
4.2 Measuring Instruments

See list of measuring equipment of this test report.

4.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

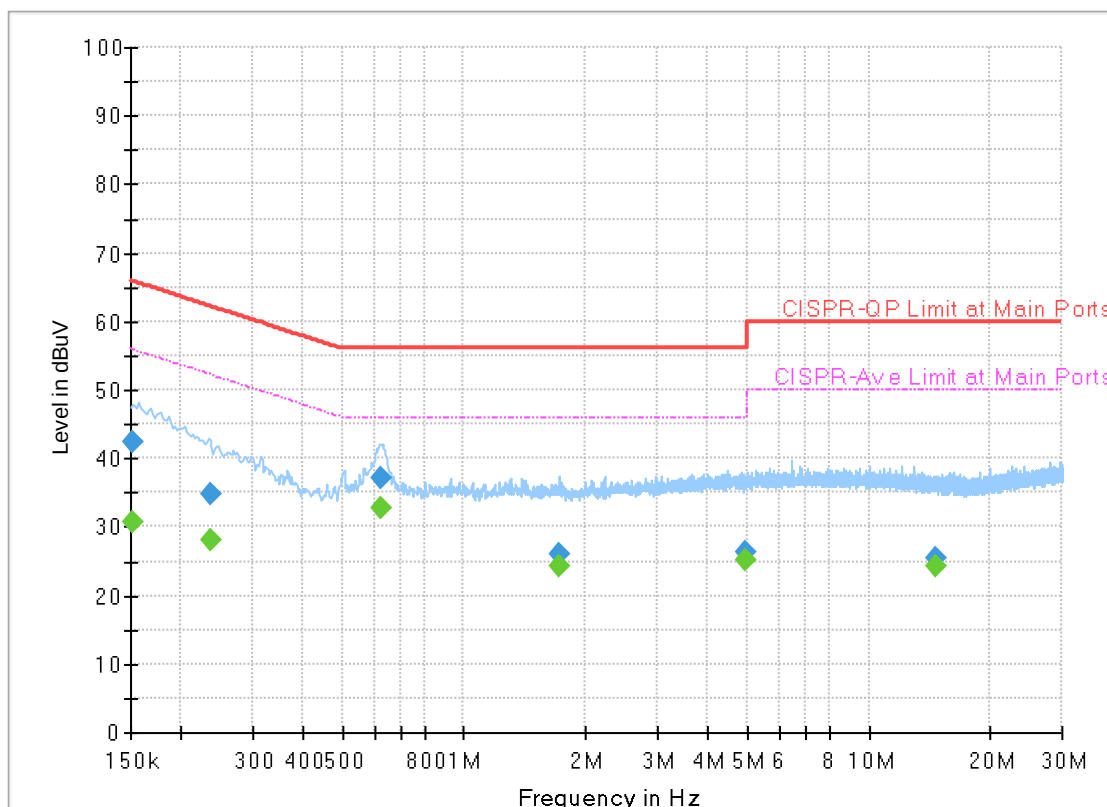
4.4 Test Setup



AMN = Artificial mains network (LISN)
 AE = Associated equipment
 EUT = Equipment under test
 ISN = Impedance stabilization network

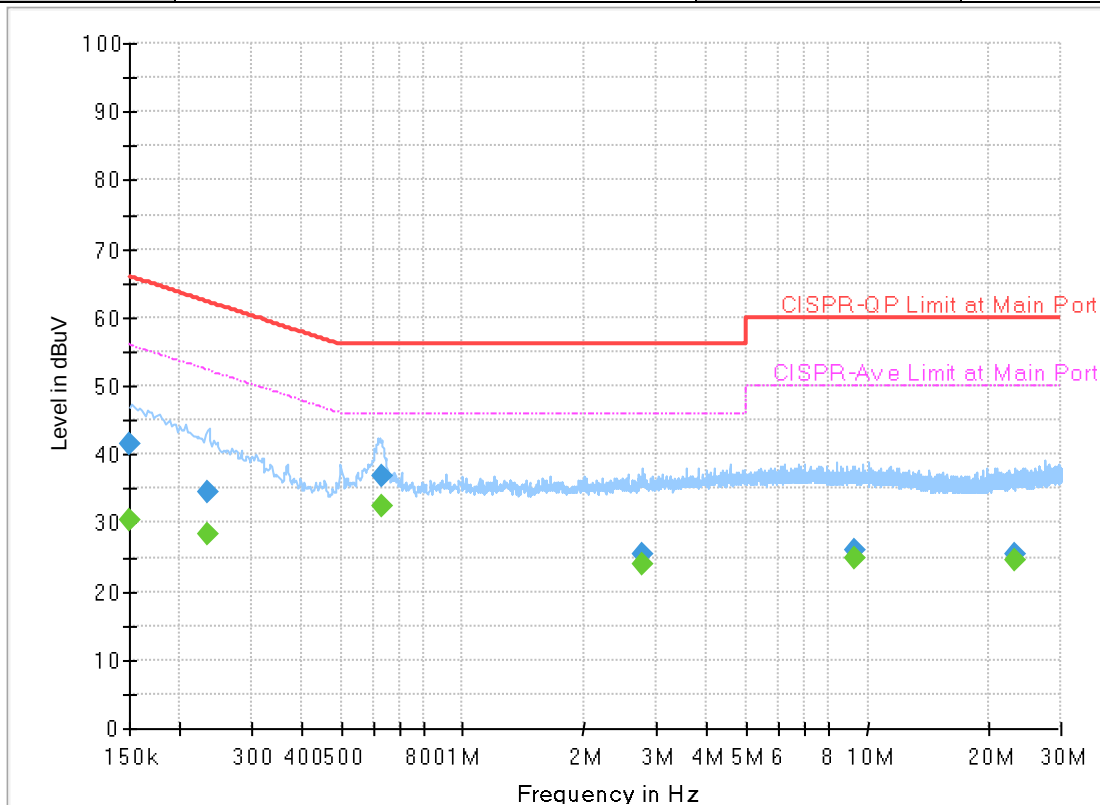
4.5 Test Result of AC Conducted Emission

Test Engineer :	Howard Huang	Temperature :	22.3~24.7℃
		Relative Humidity :	36.7~38.2%
Test Voltage :	120Vac / 60Hz	Phase :	Line



Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152340	---	30.82	55.87	25.05	L1	OFF	19.6
0.152340	42.25	---	65.87	23.62	L1	OFF	19.6
0.235590	---	27.98	52.25	24.27	L1	OFF	19.6
0.235590	34.91	---	62.25	27.34	L1	OFF	19.6
0.621600	---	32.64	46.00	13.36	L1	OFF	19.6
0.621600	37.01	---	56.00	18.99	L1	OFF	19.6
1.718250	---	24.21	46.00	21.79	L1	OFF	19.6
1.718250	26.13	---	56.00	29.87	L1	OFF	19.6
4.956180	---	25.12	46.00	20.88	L1	OFF	19.8
4.956180	26.39	---	56.00	29.61	L1	OFF	19.8
14.638200	---	24.41	50.00	25.59	L1	OFF	20.2
14.638200	25.41	---	60.00	34.59	L1	OFF	20.2

Test Engineer :	Howard Huang	Temperature :	22.3~24.7℃
		Relative Humidity :	36.7~38.2%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral



Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.150000	---	30.47	56.00	25.53	N	OFF	19.6
0.150000	41.53	---	66.00	24.47	N	OFF	19.6
0.233880	---	28.41	52.31	23.90	N	OFF	19.5
0.233880	34.50	---	62.31	27.81	N	OFF	19.5
0.627000	---	32.59	46.00	13.41	N	OFF	19.5
0.627000	36.98	---	56.00	19.02	N	OFF	19.5
2.766750	---	24.12	46.00	21.88	N	OFF	19.6
2.766750	25.56	---	56.00	30.44	N	OFF	19.6
9.320100	---	24.99	50.00	25.01	N	OFF	19.8
9.320100	26.11	---	60.00	33.89	N	OFF	19.8
23.142750	---	24.51	50.00	25.49	N	OFF	20.0
23.142750	25.38	---	60.00	34.62	N	OFF	20.0



5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	Rohde & Schwarz	FSV30	103738	9kHz~30GHz	May 14, 2020	May 30, 2020~ Jun. 15, 2020	May 14, 2021	Radiation (03CH18-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801589/2	30MHz~40GHz	Dec. 23, 2019	May 30, 2020~ Jun. 15, 2020	Dec. 22, 2020	Radiation (03CH18-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30M~40GHz	Feb. 25, 2020	May 30, 2020~ Jun. 15, 2020	Feb. 24, 2021	Radiation (03CH18-HY)
Detector	Quinstars	QEA-FBFBVP	2672009	50 ~ 75 GHz	Jun. 06, 2020	Jun. 08, 2020~ Jun. 15, 2020	Jun. 05, 2021	Radiation (03CH18-HY)
Amplifier	Quinstars	QLW-5075453 0-I2	953600006	50 ~ 75 GHz	Jul. 20, 2018	Jun. 08, 2020~ Jun. 15, 2020	Jul. 19, 2020	Radiation (03CH18-HY)
Oscilloscope	Rohde & Schwarz	RTO 1022	400025	600MHz, 10GSa/sec	Sep. 04, 2019	Jun. 08, 2020~ Jun. 15, 2020	Sep. 03, 2020	Radiation (03CH18-HY)
Power Meter	Agilent	E4416A	GB4129234 4	N/A	Dec. 27, 2019	Jun. 08, 2020~ Jun. 15, 2020	Dec. 26, 2020	Radiation (03CH18-HY)
Power Sensor	Keysight	V8486A	MY5920000 6	50 ~ 75 GHz	Nov. 04, 2019	Jun. 08, 2020~ Jun. 15, 2020	Nov. 04, 2020	Radiation (03CH18-HY)
Signal Generator	Anritsu	MG3710A	6261943042	100kHz ~ 40GHz	May. 10, 2020	Jun. 03, 2020 - Jun. 16, 2020	May. 09, 2021	Radiation (03CH18-HY)
Passive Frequency Multiplier	SAGE	SFP-152KF-S 1	SN- PFM02	50 ~ 75 GHz	N.C.R	Jun. 03, 2020 - Jun. 16, 2020	N.C.R	Radiation (03CH18-HY)
Mixer*	Rohde & Schwarz	FS-Z60	100986	40 ~ 60 GHz	Oct. 31, 2018	Jun. 02, 2020~ Jun. 13, 2020	Oct. 30, 2021	Radiation (03CH18-HY)
Mixer*	Rohde & Schwarz	FS-Z75	101557	50 ~ 75 GHz	Jan. 24, 2019	Jun. 02, 2020~ Jul. 15, 2020	Jan. 23, 2021	Radiation (03CH18-HY)
Mixer*	Rohde & Schwarz	FS-Z90	101811	60 ~ 90 GHz	Jul. 16, 2018	Jun. 02, 2020~ Jun. 13, 2020	Jul. 15, 2021	Radiation (03CH18-HY)
Mixer*	Rohde & Schwarz	FS-Z140	101130	90 ~ 140 GHz	Sep. 4, 2018	Jun. 02, 2020~ Jun. 13, 2020	Sep. 03, 2021	Radiation (03CH18-HY)
Mixer*	Rohde & Schwarz	FS-Z220	10104	140 ~ 220 GHz	Aug. 27, 2018	Jun. 02, 2020~ Jun. 13, 2020	Aug. 26, 2021	Radiation (03CH18-HY)
Thermal Chamber	ESPEC	LHU-113	1012005860	N/A	Dec. 12, 2019	Jun. 09, 2020	Dec. 11, 2020	Thermal (03CH18-HY)
Standard Horn Antenna	Quinstar	QWH-UPRR00	923600007	40 ~ 60 GHz	Aug. 17, 2018	May 30, 2020~ Jun. 13, 2020	Aug. 16, 2021	Radiation (03CH18-HY)
Standard Horn Antenna	Quinstar	QWH-EPRR00	784600034	60 ~ 90 GHz	Aug. 17, 2018	Jun. 02, 2020~ Jun. 13, 2020	Aug. 16, 2021	Radiation (03CH18-HY)
Standard Horn Antenna	Quinstar	QWH-FPRR00	923800008	90 ~ 140 GHz	Aug. 17, 2018	Jun. 02, 2020~ Jun. 13, 2020	Aug. 16, 2021	Radiation (03CH18-HY)
Standard Horn Antenna	Quinstar	QWH-GPRR0 0	923800009	140 ~ 220 GHz	Aug. 17, 2018	Jun. 02, 2020~ Jun. 13, 2020	Aug. 16, 2021	Radiation (03CH18-HY)
Standard Horn Antenna	Quinstar	QWH-VP RR00	923700007	50 ~ 75GHz	Aug. 17, 2018	Jun. 02, 2020~ Jul. 15, 2020	Aug. 16, 2021	Radiation (03CH18-HY)
AC Power Source	AC POWER	AFC-500W	F104070011	50Hz~60Hz	Apr. 09, 2020	Jul. 15, 2020	Apr. 08, 2021	Radiation (03CH18-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Software	Audix	E3 6.2009-8-24	RK-001053	N/A	N/A	Jun. 02, 2020~ Jun. 05, 2020	N/A	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 03, 2019	Jun. 02, 2020~ Jun. 05, 2020	Dec. 02, 2020	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 12, 2019	Jun. 02, 2020~ Jun. 05, 2020	Oct. 11, 2020	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Dec. 26, 2019	Jun. 02, 2020~ Jun. 05, 2020	Dec. 25, 2020	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Jun. 02, 2020~ Jun. 05, 2020	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500- B	N/A	1~4m	N/A	Jun. 02, 2020~ Jun. 05, 2020	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Jun. 02, 2020~ Jun. 05, 2020	N/A	Radiation (03CH11-HY)
EMI Test Receiver	Agilent	N9038A (MXE)	MY53290045	20MHz~8.4GHz	Jan. 18, 2020	Jun. 02, 2020~ Jun. 05, 2020	Jan. 17, 2021	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 28, 2019	Jun. 02, 2020~ Jun. 05, 2020	Oct. 27, 2020	Radiation (03CH11-HY)
Filter	Wainwright	WHK20/1000 C7/40SS	SN2	20M High Pass	Sep. 15, 2019	Jun. 02, 2020~ Jun. 05, 2020	Sep. 14, 2020	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 12, 2020	Jun. 02, 2020~ Jun. 05, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	30M-18G	Mar. 12, 2020	Jun. 02, 2020~ Jun. 05, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz~40GHz	Mar. 12, 2020	Jun. 02, 2020~ Jun. 05, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTN-303B	TP140325	N/A	Nov. 07, 2019	Jun. 02, 2020~ Jun. 05, 2020	Nov. 06, 2020	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTN-303B	TP161237	N/A	Oct. 25, 2019	Jun. 02, 2020~ Jun. 05, 2020	Oct. 24, 2020	Radiation (03CH11-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jun. 08, 2020	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 15, 2019	Jun. 08, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 07, 2019	Jun. 08, 2020	Nov. 06, 2020	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 15, 2019	Jun. 08, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Jun. 08, 2020	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 02, 2020	Jun. 08, 2020	Jan. 01, 2021	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 02, 2020	Jun. 08, 2020	Jan. 01, 2021	Conduction (CO05-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1328	1GHz ~ 18GHz	Nov. 14, 2019	Jun. 03, 2020~ Jun. 10, 2020	Nov. 13, 2020	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz ~ 40GHz	Dec. 10, 2019	Jun. 03, 2020~ Jun. 10, 2020	Dec. 09, 2020	Radiation (03CH12-HY)
Preamplifier	Jet-Power	JPA0010180 0-30-10P	1601180002	1GHz~18GHz	Feb. 07, 2020	Jun. 03, 2020~ Jun. 10, 2020	Feb. 06, 2021	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY53270148	1GHz~26.5GHz	Dec. 20, 2019	Jun. 03, 2020~ Jun. 10, 2020	Dec. 19, 2020	Radiation (03CH12-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 13, 2019	Jun. 03, 2020~ Jun. 10, 2020	Dec. 12, 2020	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Mar. 12, 2020	Jun. 03, 2020~ Jun. 10, 2020	Mar. 11, 2021	Radiation (03CH12-HY)
Hygrometer	TECPEL	DTM-303B	TP161243	N/A	Jun. 17, 2019	Jun. 03, 2020~ Jun. 10, 2020	Jun. 16, 2020	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30M-18G	Dec. 12, 2019	Jun. 03, 2020~ Jun. 10, 2020	Dec. 11, 2020	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Feb. 25, 2020	Jun. 03, 2020~ Jun. 10, 2020	Feb. 24, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30M~40GHz	Feb. 25, 2020	Jun. 03, 2020~ Jun. 10, 2020	Feb. 24, 2021	Radiation (03CH12-HY)
Filter	Wainwright	WLKS4500-8 SS	SN19	4.5GHz Low Pass Filter	Mar. 21, 2020	Jun. 03, 2020~ Jun. 10, 2020	Mar. 20, 2021	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-270 0-3000-1800 0-60ST	SN2	3GHz High Pass Filter	Jul. 15, 2019	Jun. 03, 2020~ Jun. 10, 2020	Jul. 14, 2020	Radiation (03CH12-HY)
Filter	Wainwright	WHKX8-5872 .5-6750-1800 0-40ST	SN2	6.75GHz High Pass Filter	Mar. 18, 2020	Jun. 03, 2020~ Jun. 10, 2020	Mar. 17, 2021	Radiation (03CH12-HY)
Notch Filter	Marvelous Microwave Inc	MFN_2400.2 485.S5	40009N	2.4G Notch Filter	Apr. 17, 2020	Jun. 03, 2020~ Jun. 10, 2020	Apr. 16, 2021	Radiation (03CH12-HY)
Notch Filter	ST1	STI15_9935_ 5150-5850	NA	N/A	Apr. 09, 2020	Jun. 03, 2020~ Jun. 10, 2020	Apr. 08, 2021	Radiation (03CH12-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Jun. 03, 2020~ Jun. 10, 2020	N/A	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500- B	N/A	1m~4m	N/A	Jun. 03, 2020~ Jun. 10, 2020	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jun. 03, 2020~ Jun. 10, 2020	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Jun. 03, 2020~ Jun. 10, 2020	N/A	Radiation (03CH12-HY)

Note: (*) Equipment manufacturer's Calibration Certificate.

6 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (9 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.30 dB
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Uncertainty of Radiated Emission Measurement (9 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.12 dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.20 dB
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.60 dB
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.00 dB
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Uncertainty of Radiated Emission Measurement (40 GHz ~ 140 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.80 dB
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Uncertainty of Radiated Emission Measurement (140 GHz ~ 200 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	6.80 dB
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Uncertainty of Duty Cycle Measurement (50 GHz ~ 75 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	1.50 %
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