

FCC EMI TEST REPORT

Filing Type : Certification
FCC ID : J9C-QC64MA
Equipment : QC64MA 802.11ad/ay module
Brand Name : Qualcomm Technologies, Inc.
Model Name : QC64MA
Applicant : Qualcomm Technologies, Inc.
5775 Morehouse Drive, San Diego, California,
United States 92121
Manufacturer : Qualcomm Technologies, Inc.
5775 Morehouse Drive, San Diego, California,
United States 92121
Standard : 47 CFR FCC Rules and Regulations Part 15
Subpart B Class B Digital Device

The product was received on Apr. 08, 2019, and testing was started from Apr. 12, 2019 and completed on May 07, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.4-2014 and shown 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: Sin Chang

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



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TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB Ver1.0



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
4	15.107	AC Power Port Conducted Emission	PASS	Under limit 19.44 dB at 0.537 MHz
5	15.109	Radiated Emission below 1GHz	PASS	Under limit 6.46 dB at 65.89 MHz
5	15.109	Radiated Emission above 1GHz	PASS	Under limit 6.80 dB at 7289.96 MHz

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 test configuration, test mode and test software were written in this test report are declared by the manufacturer.

Reviewed by: Sin Chang

Report Producer: Wendy Pan

1. General Description of Equipment under Test

Product Detail	
Equipment Name	QC64MA 802.11ad/ay module
Model Name	QC64MA
Brand Name	Qualcomm Technologies, Inc.
Power Supply	From host system
Accessories	N/A

1.1. Feature of Equipment under Test

1. The EUT's highest operating frequency is 64.8GHz.
2. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

1.2. Modification of EUT

Please refer to the technical specifications of EUT.

2. Test Configuration of Equipment under Test

2.1. Test Mode

The following table is a list of the test modes shown in this test report.

Conducted Emissions	
Test Mode	Description
1	Normal Link - AP mode

Radiated Emissions	
The EUT was performed at X axis, Y axis and Z axis position and the worst case was found at Z axis. So the measurement will follow this same test configuration.	
Test Mode	Description
1	Normal Link - EUT in Z axis AP mode

Note: The EUT has two mode one is AP mode and other is STA mode, only the AP mode was tested and recorded in this test report that is designated by the manufacturer.

2.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

For Conducted Emissions test:

No.	Support Unit	Brand	Model	FCC ID
A	PC	GIGABYTE	GB-BSi3H-6100	N/A
B	NB	HP	8470w	N/A
C	Device	Qualcomm	QC64MA	N/A
D	PC	GIGABYTE	GB-BKi5HA-7200	N/A
E	Fixture	Qualcomm	25-YB407-P1	N/A
F	Fixture	Qualcomm	25-YB407-P1	N/A
G	Keyboard	iCooky	SK068	N/A
H	Mouse	Logitech	M-U0026	N/A
I	Printer	EPSON	LQ-300+	N/A
J	Modem	ACEEX	DM1414	N/A
K	LCD Monitor	SAMSUNG	LS19MJEKBZ/XTW	N/A

For Radiated Emissions test:

No.	Support Unit	Brand	Model	FCC ID
A	PC	GIGABYTE	GB-BSi3H-6100	N/A
B	Notebook	HP	8470w	N/A
C	Device	Qualcomm	QC64MA	N/A
D	PC	GIGABYTE	GB-BKi5HA-7200	N/A
E	Fixture	Qualcomm	25-YB407-P1	N/A
F	Fixture	Qualcomm	25-YB407-P1	N/A
G	Keyboard	iCooky	SK068	N/A
H	Mouse	Logitech	M-U0026	N/A
I	Printer	EPSON	LQ-300+	N/A
J	Modem	ACEEX	DM1414	N/A
K	LCD Monitor	SAMSUNG	LS19MJEKBZ/XTW	N/A



2.3. EUT Operation Condition

During the test, the following programs under Win 10 were executed:

The remote notebook executed "ping.exe" to link with the EUT to maintain the connection by 60GHz.

The remote notebook executed "SSH Secure Shell Client" to traffic packet data and sent instruction to 60GHz device.

An executive program, EMCTEST.EXE under Linux, which generates a complete line of continuously repeating " H " pattern was used as the test software.

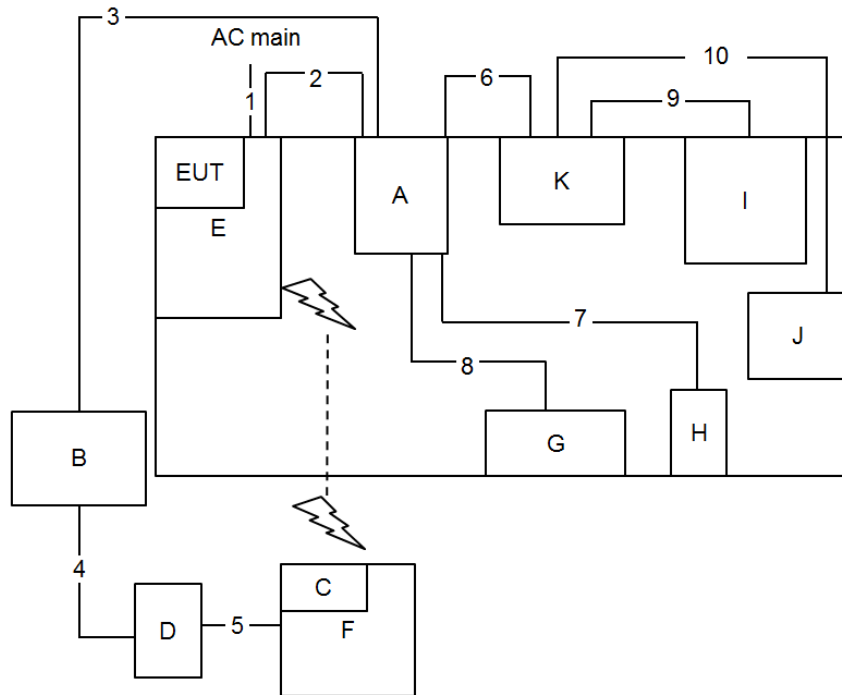
The program was executed as follows :

- a. Turn on the power of all equipment.
- b. The PC sends " H " messages to the monitor, and the monitor displays " H " patterns on the screen.
- c. The PC sends " H " messages to the printer, then the printer prints them on the paper.
- d. The PC sends " H " messages to the modem.

Repeat the steps from b to d.

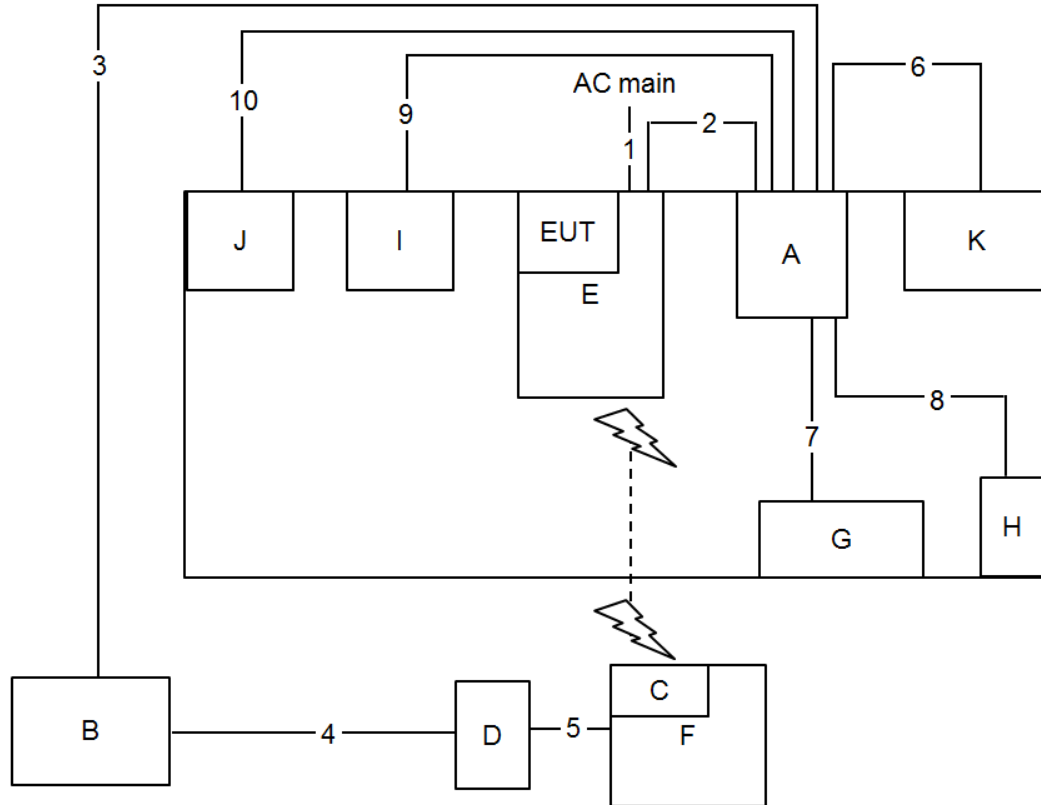
2.4. Connection Diagram of Test System

2.4.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power Cable	No	2.9m
2	Cable	Yes	0.4m
3	RJ-45 Cable	No	10m
4	RJ-45 Cable	No	10m
5	Cable	No	0.4m
6	VGA Cable	Yes	1.8m
7	USB Cable	Yes	1.8m
8	USB Cable	Yes	1.8m
9	USB Cable	Yes	1.8m
10	RS-232 to USB Cable	Yes	2.6m

2.4.2. Radiation Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power Cable	No	2.9m
2	Cable	Yes	0.15m
3	RJ-45 Cable	No	10m
4	RJ-45 Cable	No	10m
5	Cable	No	0.4m
6	VGA Cable	Yes	1.8m
7	USB Cable	Yes	1.8m
8	USB Cable	Yes	1.8m
9	USB Cable	Yes	1.8m
10	RS-232 to USB Cable	Yes	2.6m



3. General Information of Test

3.1. Test Facility

EMI	
JHU BEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C. TEL : 886-3-656-9065 FAX : 886-3-656-9085

3.2. Test Environment

Test Items	Test Site No.	Test Engineer	Test Environment			Test Date	Remark
			Temp (°C)	Humidity (%)	Pressure (kPa)		
AC Power Port Conducted Emission	CO01-CB	Ryo Fan	23.7~24	61~61.2	-	Apr. 12, 2019	Mode 1
Radiated Emission below 1GHz	03CH01-CB	Cola Fan	22~24	54~56	-	May 07, 2019	Mode 1
Radiated Emission above 1GHz	03CH01-CB	Cola Fan	22~24	54~56	-	Apr. 16, 2019	Mode 1

3.3. Test Voltage

Power Type	Test Voltage
AC Power Supply	120 V / 60 Hz

3.4. Standard for Methods of Measurement

ANSI C63.4-2014

3.5. Frequency Range Investigated

Test Items	Frequency Range
Conducted emission test	150 kHz to 30 MHz
Radiated emission test	30 MHz to 40,000 MHz

3.6. Test Distance

Test Items	Test Distance
Radiated emission test below 1 GHz (30 MHz to 1,000 MHz)	3 m
Radiated emission test above 1 GHz (1,000 MHz to 18,000 MHz)	3 m
Radiated emission test above 1 GHz (18,000 MHz to 40,000 MHz)	1 m

4. Test of Conducted Emission

4.1. Limit

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

4.2. Description of Major Test Instruments

Test Receiver	Setting
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.3. Test Procedures

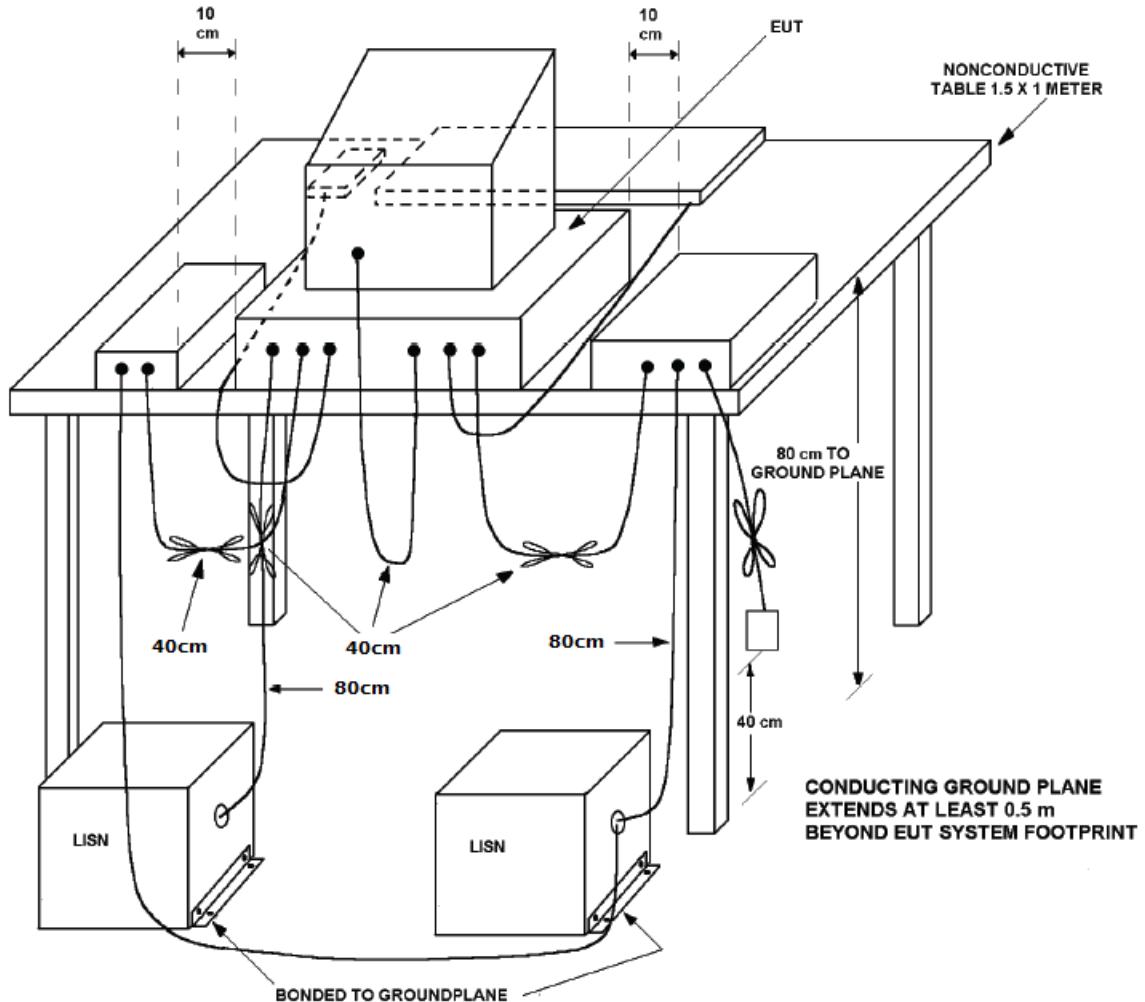
- The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connect to the other LISN.
- The LISN provides 50 Ω coupling impedance for the measuring instrument.
- The FCC states that a 50 Ω , 50 μ H LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

4.4. Measurement Results Calculation

The measured Level is calculated using:

- Corrected Reading (dBuV) = LISN Factor + Cable Loss + Read Level = Level
- Margin = - Limit + (Read Level + LISN Factor + Cable Loss)

4.5. Typical Test Setup Layout of Conducted Emission



4.6. Test Result of AC Power Ports

Refer as Appendix A

5. Test of Radiated Emission

5.1. Limit

Radiated Emission below 1 GHz test at 3 m:

Frequency (MHz)	QP (dBuV/m)
30~88	40
88~216	43.5
216~960	46
Above 960	54

Radiated Emission 1~18 GHz test at 3 m:

Frequency (MHz)	PK (dBuV/m)	AV (dBuV/m)
1,000 to 18,000	74	54

Radiated Emission 18~40 GHz test at 1 m:

Frequency (MHz)	PK (dBuV/m)	AV (dBuV/m)
18,000 to 40,000	83.54	63.54

5.2. Description of Major Test Instruments

5.2.1. 30 MHz ~ 1,000 MHz

Receiver Parameter	Setting
Start Frequency	30 MHz
Stop Frequency	1000 MHz
RBW	120 kHz for QP

5.2.2. Above 1 GHz

Spectrum Parameter	Setting
Start Frequency	1000 MHz
Stop Frequency	5th harmonic of the highest frequency or 40 GHz, whichever is lower.
RBW / VBW	1 MHz / 3 MHz for Peak ; 1 MHz / 1 Hz for Average



5.3. Test Procedures

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3m (below 1GHz) / 3m (1GHz-18GHz) / 1m (18GHz-40GHz) meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

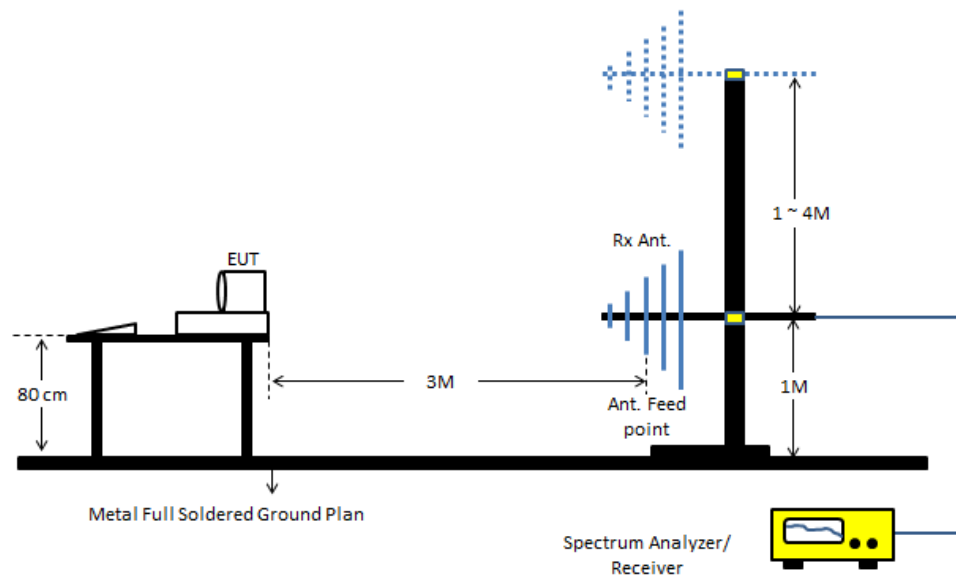
5.4. Measurement Results Calculation

The measured Level is calculated using:

- a. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
- b. Margin = - Limit + (Read Level + Antenna Factor + Cable Loss - Preamp Factor)

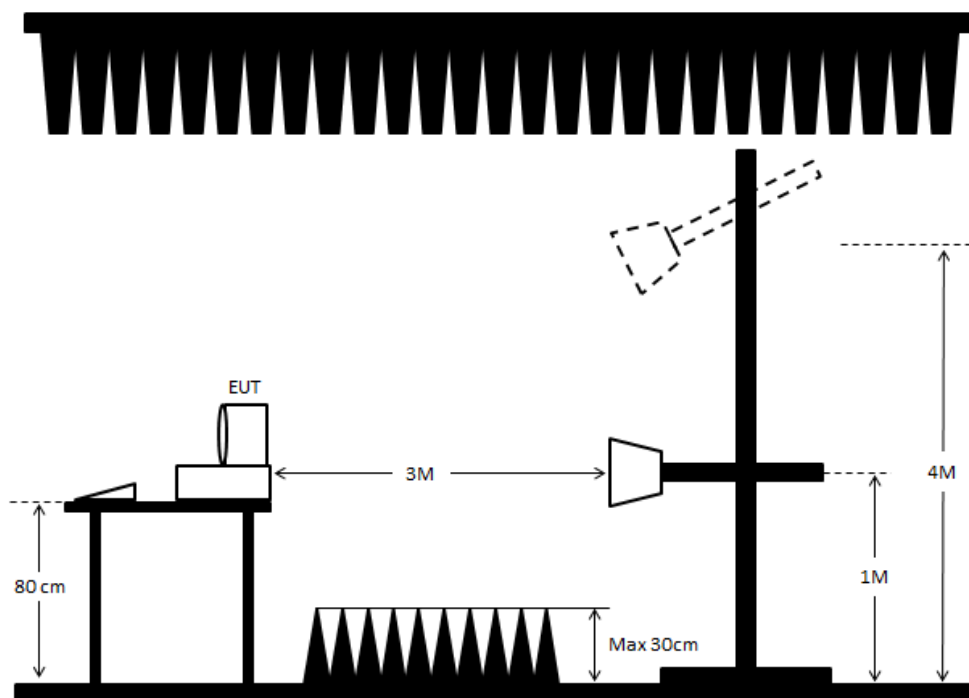
5.5. Typical Test Setup Layout of Radiated Emission

<Below 1 GHz>:

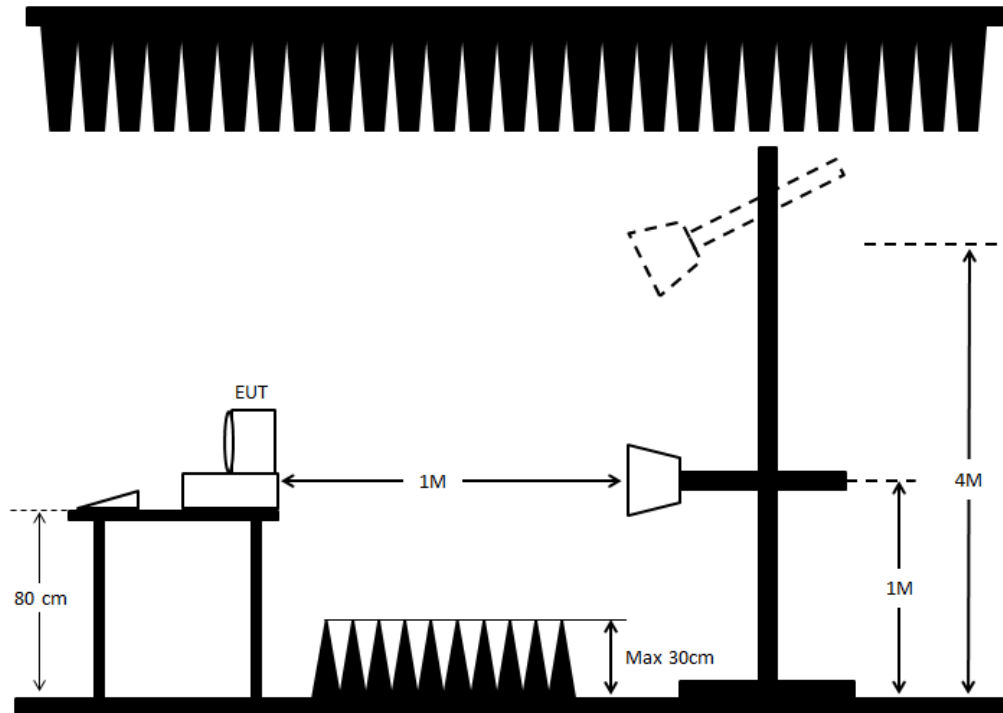


<Above 1 GHz>:

1,000~18,000 MHz



18,000~40,000 MHz





5.6. Test Result of Radiated Emission below 1 GHz

Refer as Appendix B

5.7. Test Result of Radiated Emission above 1 GHz

Refer as Appendix B

6. List of Measuring Equipment Used

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 28, 2019	Jan. 29, 2020	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-1 6-2	04083	150kHz ~ 100MHz	Dec. 24, 2018	Dec. 23, 2019	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Jan. 11, 2019	Jan. 10, 2020	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	150kHz ~ 30MHz	May 22, 2018	May 21, 2019	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA with 6dB Attenuator	TESEQ & EMCI	CBL6112D & N-6-06	37880 & AT-N0609	20MHz ~ 2GHz	Aug. 27, 2018	Aug. 26, 2019	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 13, 2018	Nov. 12, 2019	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jun. 28, 2018	Jun. 27, 2019	Radiation (03CH01-CB)
Pre-Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz	May 23, 2018	May 22, 2019	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 08, 2019	Jan. 07, 2020	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-H G	1864479	18GHz ~ 40GHz	Jul. 04, 2018	Jul. 03, 2019	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Jan. 31, 2019	Jan. 30, 2020	Radiation (03CH01-CB)
EMI Test Receiver	R&S	ESCS	100359	9kHz ~ 2.75GHz	Jul. 03, 2018	Jul. 02, 2019	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH01-CB)

※ Calibration Interval of instruments listed above is one year.

※ N.C.R. means Non-Calibration required.

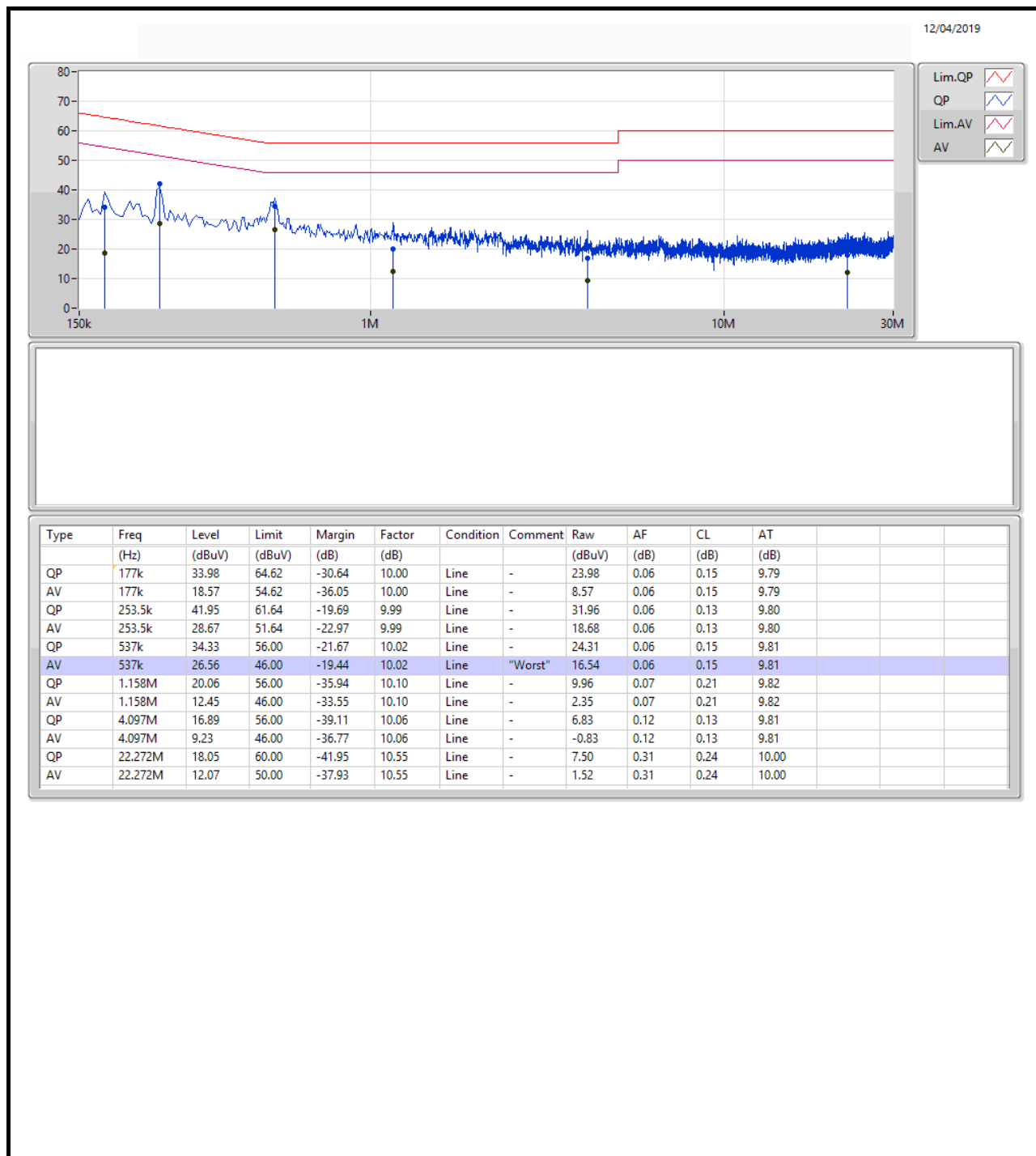


7. Uncertainty of Test Site

Test Items	Uncertainty	Remark
Conducted Emissions	2.0 dB	Confidence levels of 95%
Radiated Emissions below 1GHz	3.6 dB	Confidence levels of 95%
Radiated Emissions 1GHz ~ 18GHz	3.7 dB	Confidence levels of 95%
Radiated Emissions 18GHz ~ 40GHz	3.5 dB	Confidence levels of 95%

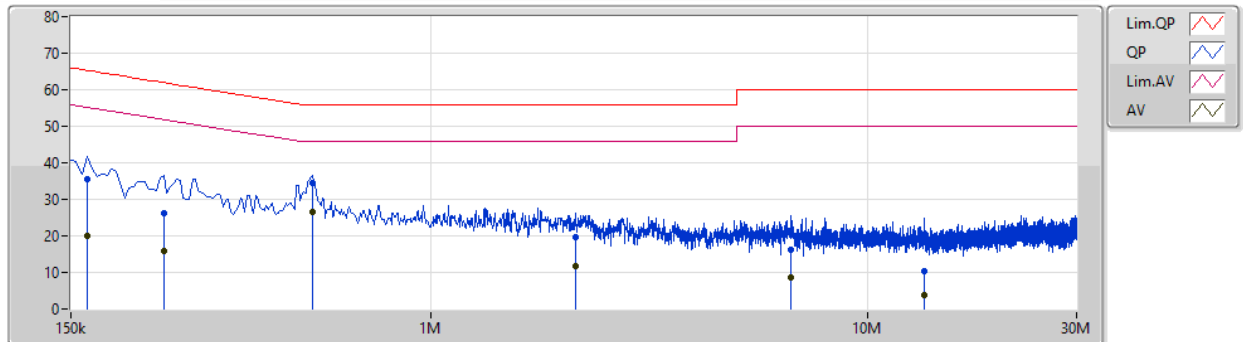
Test Mode	Mode 1	Frequency Range	0.15 MHz to 30 MHz
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Line



Neutral

12/04/2019



Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	AF (dB)	CL (dB)	AT (dB)			
QP	163.5k	35.52	65.27	-29.75	9.99	Neutral	-	25.53	0.04	0.16	9.79			
AV	163.5k	19.90	55.27	-35.37	9.99	Neutral	-	9.91	0.04	0.16	9.79			
QP	244.5k	26.33	61.95	-35.62	9.97	Neutral	-	16.36	0.04	0.13	9.80			
AV	244.5k	15.90	51.95	-36.05	9.97	Neutral	-	5.93	0.04	0.13	9.80			
QP	537k	34.35	56.00	-21.65	10.01	Neutral	-	24.34	0.05	0.15	9.81			
AV	537k	26.56	46.00	-19.44	10.01	Neutral	"Worst"	16.55	0.05	0.15	9.81			
QP	2.139M	19.69	56.00	-36.31	10.12	Neutral	-	9.57	0.07	0.22	9.83			
AV	2.139M	11.73	46.00	-34.27	10.12	Neutral	-	1.61	0.07	0.22	9.83			
QP	6.662M	16.14	60.00	-43.86	10.16	Neutral	-	5.98	0.15	0.14	9.87			
AV	6.662M	8.60	50.00	-41.40	10.16	Neutral	-	-1.56	0.15	0.14	9.87			
QP	13.443M	10.43	60.00	-49.57	10.34	Neutral	-	0.09	0.22	0.20	9.92			
AV	13.443M	3.68	50.00	-46.32	10.34	Neutral	-	-6.66	0.22	0.20	9.92			

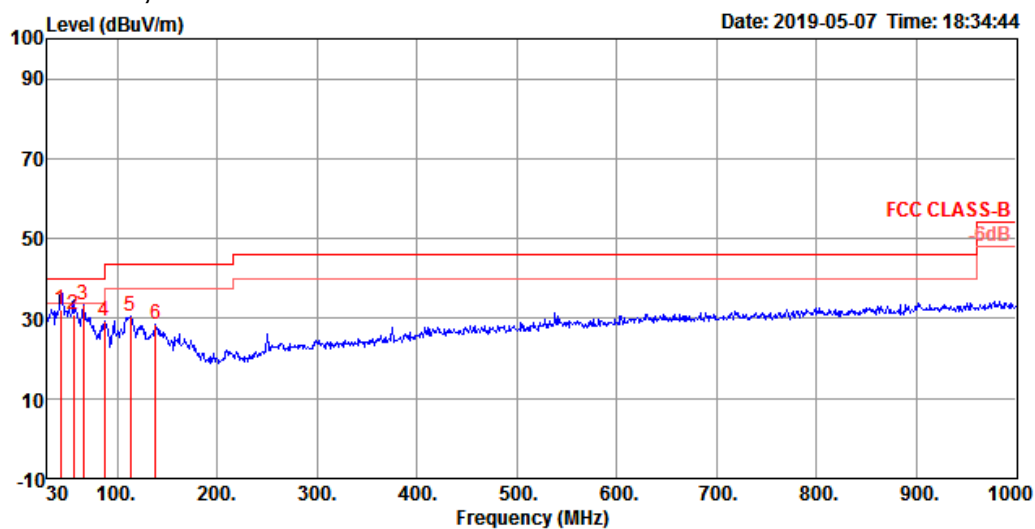


Radiated Emission below 1GHz Result

Appendix B.1

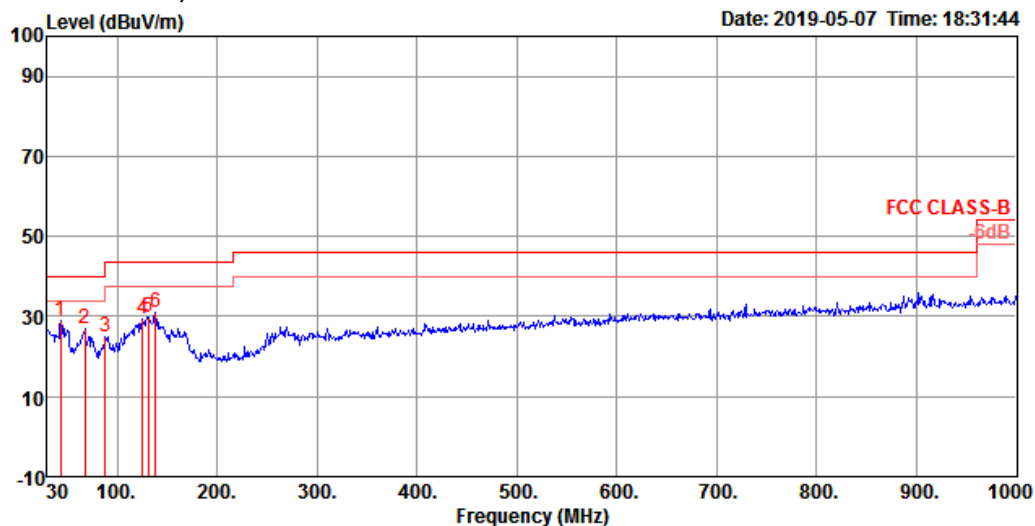
Test Mode	Mode 1	Frequency Range	30 MHz to 1,000 MHz
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Vertical 30 MHz to 1,000 MHz



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	43.58	32.34	40.00	-7.66	47.56	0.65	16.55	32.42	100	37 QP	VERTICAL
2	56.19	31.11	40.00	-8.89	50.24	0.77	12.51	32.41	125	233 QP	VERTICAL
3	65.89	33.54	40.00	-6.46	53.06	0.84	12.04	32.40	100	182 Peak	VERTICAL
4	87.23	29.56	40.00	-10.44	46.87	0.97	14.10	32.38	125	227 Peak	VERTICAL
5	113.42	30.58	43.50	-12.92	43.72	1.10	18.12	32.36	125	186 Peak	VERTICAL
6	138.64	28.50	43.50	-15.00	42.41	1.22	17.21	32.34	100	71 Peak	VERTICAL

Horizontal 30 MHz to 1,000 MHz



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	43.58	28.90	40.00	-11.10	44.12	0.65	16.55	32.42	150	319	Peak HORIZONTAL
2	67.83	27.12	40.00	-12.88	46.60	0.85	12.07	32.40	200	283	Peak HORIZONTAL
3	88.20	25.02	43.50	-18.48	42.02	0.99	14.39	32.38	200	164	Peak HORIZONTAL
4	125.06	29.27	43.50	-14.23	42.38	1.15	18.09	32.35	200	180	Peak HORIZONTAL
5	130.88	29.83	43.50	-13.67	43.05	1.18	17.94	32.34	200	180	Peak HORIZONTAL
6	138.64	30.91	43.50	-12.59	44.82	1.22	17.21	32.34	200	189	Peak HORIZONTAL

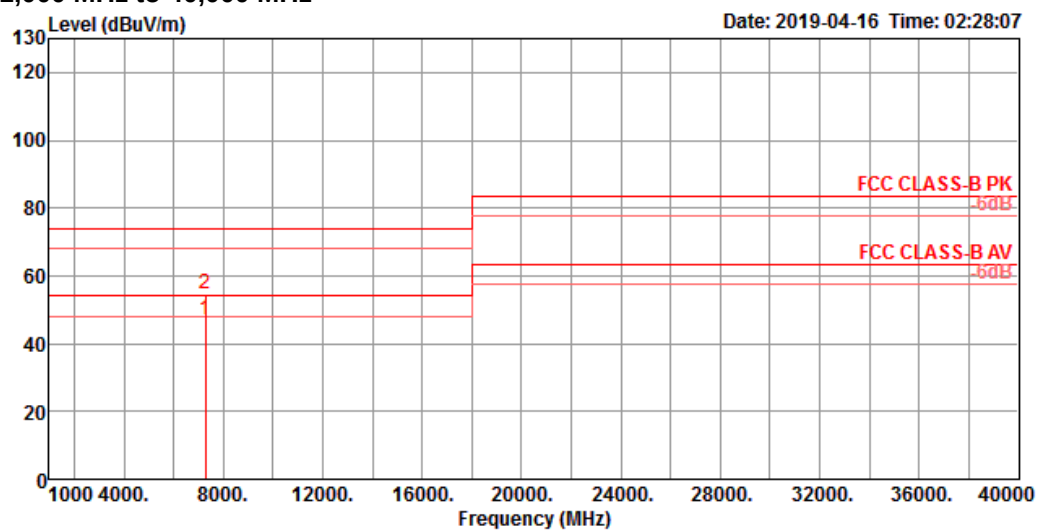


Radiated Emission above 1GHz Result

Appendix B.2

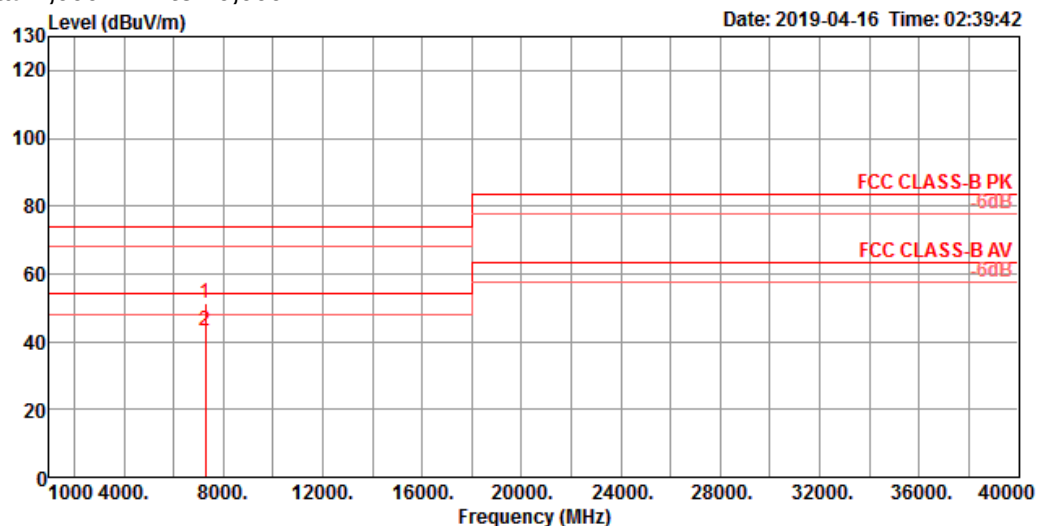
Test Mode	Mode 1	Frequency Range	1,000 MHz to 40,000 MHz
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Vertical 1,000 MHz to 40,000 MHz



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	7289.96	47.20	54.00	-6.80	39.58	6.46	36.47	35.31	122	190 Average	VERTICAL
2	7290.07	54.68	74.00	-19.32	47.06	6.46	36.47	35.31	122	190 Peak	VERTICAL

Horizontal 1,000 MHz to 40,000 MHz



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	7289.92	51.53	74.00	-22.47	43.91	6.46	36.47	35.31	103	182 Peak	HORIZONTAL
2	7289.94	42.99	54.00	-11.01	35.37	6.46	36.47	35.31	103	182 Average	HORIZONTAL