11n-HT20 2437MHz

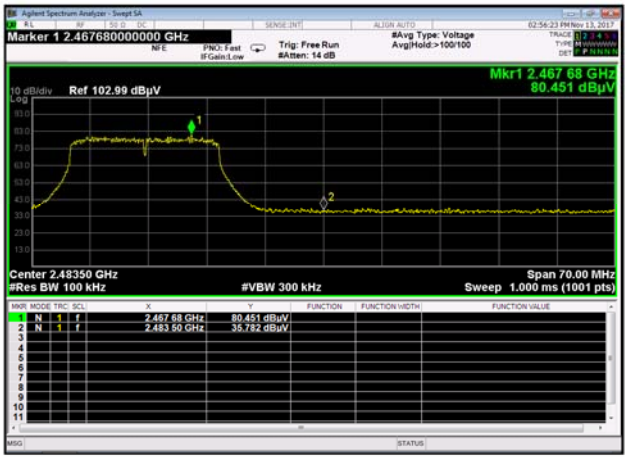
Measured Frequency (MHz)	Correction Factor (dB/m)	Meter Reading Horizontal Polarization (dBµV)	Meter Reading Vertical Polarization (dBµV)	Maximum Field Strength (dBµV/m)	Limit (dBµV/m)	Margin for Limit (dB)
Measurement with the Peak Detector						
3282.55	-1.6	47.9	48.6	47.0	74.0	27.0
4874.00	0.3	53.9	54.9	55.2	74.0	18.8
6498.66	-7.5	57.2	57.0	49.7	74.0	24.3
7311.00	-5.7	52.9	51.1	47.2	74.0	26.8
9748.00	-1.9	47.7	48.0	46.1	74.0	27.9
Measurement with the Average Detector						
3282.55	-1.6	41.3	40.1	39.7	54.0	14.3
4874.00	0.3	43.6	44.5	44.8	54.0	9.2
6498.66	-7.5	55.0	55.0	47.5	54.0	6.5
7311.00	-5.7	40.0	39.5	34.3	54.0	19.7
9748.00	-1.9	37.4	35.5	35.5	54.0	18.5

11n-HT20 2462MHz

Measured Frequency (MHz)	Correction Factor (dB/m)	Meter Reading Horizontal Polarization (dBµV)	Meter Reading Vertical Polarization (dBµV)	Maximum Field Strength (dBµV/m)	Limit (dBµV/m)	Margin for Limit (dB)
Measurement with the Peak Detector						
2483.50	7.0	50.2	48.9	57.2	74.0	16.8
3282.69	-1.6	47.7	48.0	46.4	74.0	27.6
4924.00	0.4	54.6	52.8	55.0	74.0	19.0
6565.28	-7.4	59.2	52.5	51.8	74.0	22.2
7386.00	-5.5	56.8	53.4	51.3	74.0	22.7
9848.00	-1.8	48.1	52.8	51.0	74.0	23.0
Measurement with the Average Detector						
2483.50	7.0	36.6	36.2	43.6	54.0	10.4
3282.69	-1.6	39.8	40.3	38.7	54.0	15.3
4924.00	0.4	44.4	45.3	45.7	54.0	8.3
6565.28	-7.4	57.1	50.3	49.7	54.0	4.3
7386.00	-5.5	43.2	39.4	37.7	54.0	16.3
9848.00	-1.8	36.6	35.3	34.8	54.0	19.2

[Restricted-band band-edge plot]

Horizontal Polarization



Vertical Polarization

11n-HT40 2422MHz

Measured Frequency (MHz)	Correction Factor (dB/m)	Meter Reading Horizontal Polarization (dBµV)	Meter Reading Vertical Polarization (dBµV)	Maximum Field Strength (dBµV/m)	Limit (dBµV/m)	Margin for Limit (dB)
Measurement with the Peak Detector						
2390.00	6.7	51.0	52.0	58.7	74.0	15.3
3269.30	-1.6	48.6	49.3	47.7	74.0	26.3
4844.00	0.3	53.0	52.5	53.3	74.0	20.7
6485.56	-7.5	59.8	54.4	52.3	74.0	21.7
7266.00	-5.8	49.6	52.1	46.3	74.0	27.7
9688.00	-1.8	48.5	47.4	46.7	74.0	27.3
Measurement with the Average Detector						
2390.00	6.7	39.6	42.0	48.7	54.0	5.3
3269.30	-1.6	41.2	42.1	40.5	54.0	13.5
4844.00	0.3	43.4	43.7	44.0	54.0	10.0
6485.56	-7.5	58.5	50.9	51.0	54.0	3.0
7266.00	-5.8	36.6	39.0	33.2	54.0	20.8
9688.00	-1.8	38.9	35.9	37.1	54.0	16.9

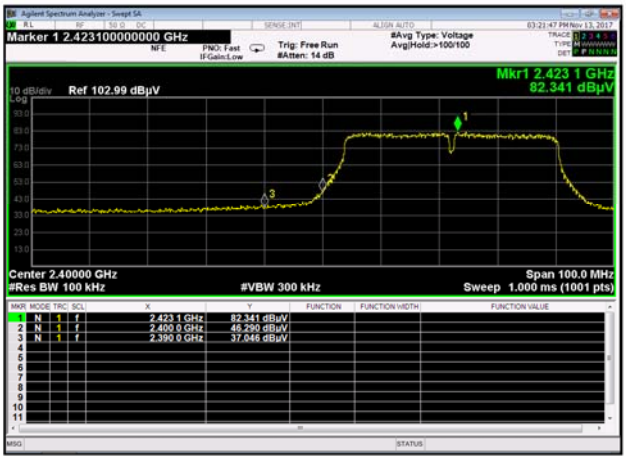
[20dBc Data Sheet]

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading Horizontal Polarization (dBµV)	Meter Reading Vertical Polarization (dBµV)	Maximum Field Strength (dBµV/m)	Limit (dBµV/m)	Margin for Limit (dB)
Peak measurement						
*1) 2422.00	6.8	82.4	-	89.2	-	-
2400.00	6.7	46.3	-	53.0	69.2	16.2
*1) 2422.00	6.8	-	85.5	92.3	-	-
2400.00	6.7	-	49.6	56.3	72.3	16.0

[Note]
*1) : Carrier

[Restricted-band band-edge plot]

Horizontal Polarization



Vertical Polarization

11n-HT40 2437MHz

Measured Frequency (MHz)	Correction Factor (dB/m)	Meter Reading Horizontal Polarization (dBµV)	Meter Reading Vertical Polarization (dBµV)	Maximum Field Strength (dBµV/m)	Limit (dBµV/m)	Margin for Limit (dB)
Measurement with the Peak Detector						
3249.35	-1.5	48.2	48.9	47.4	74.0	26.6
4874.00	0.3	51.5	53.3	53.6	74.0	20.4
6498.87	-7.5	59.8	54.2	52.3	74.0	21.7
7311.00	-5.7	52.0	52.2	46.5	74.0	27.5
9748.00	-1.9	48.1	47.1	46.2	74.0	27.8
Measurement with the Average Detector						
3249.35	-1.5	41.6	42.0	40.5	54.0	13.5
4874.00	0.3	42.2	44.0	44.3	54.0	9.7
6498.87	-7.5	58.5	51.1	51.0	54.0	3.0
7311.00	-5.7	38.6	38.2	32.9	54.0	21.1
9748.00	-1.9	37.5	35.3	35.6	54.0	18.4

11n-HT40 2452MHz

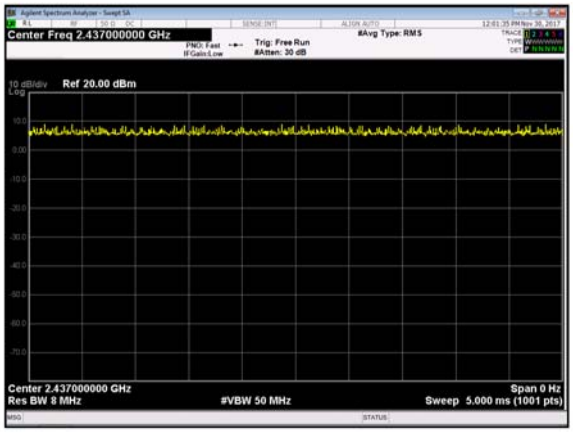
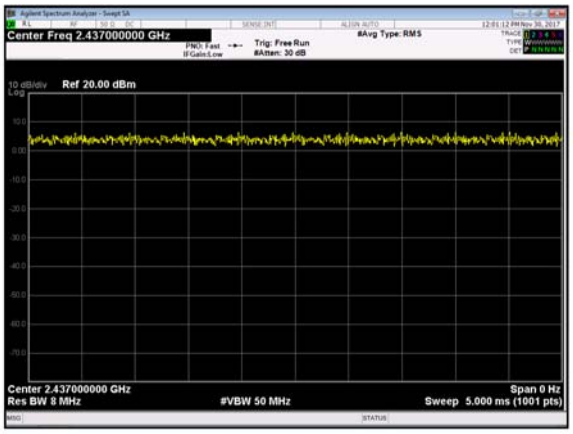
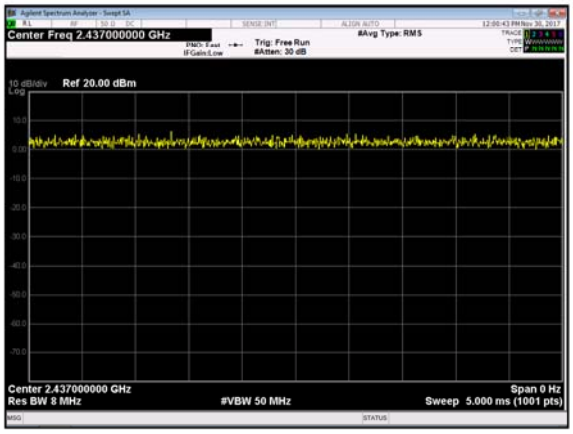
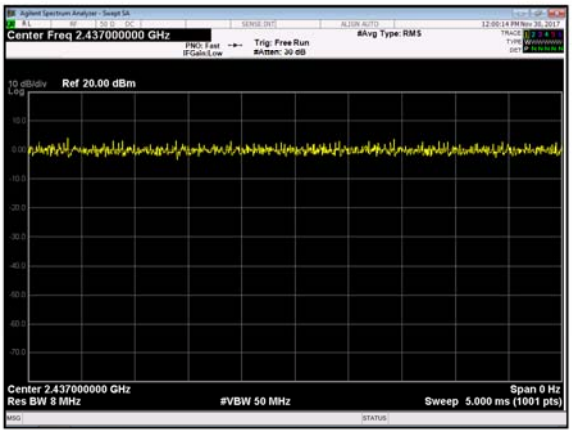
Measured Frequency (MHz)	Correction Factor (dB/m)	Meter Reading Horizontal Polarization (dBµV)	Meter Reading Vertical Polarization (dBµV)	Maximum Field Strength (dBµV/m)	Limit (dBµV/m)	Margin for Limit (dB)
Measurement with the Peak Detector						
2483.50	7.0	49.0	47.9	56.0	74.0	18.0
3269.30	-1.6	49.2	49.3	47.7	74.0	26.3
4904.00	0.4	51.6	52.6	53.0	74.0	21.0
6538.64	-7.4	59.6	55.3	52.2	74.0	21.8
7356.00	-5.5	51.3	52.7	47.2	74.0	26.8
9808.00	-1.8	48.1	47.8	46.3	74.0	27.7
Measurement with the Average Detector						
2483.50	7.0	38.6	37.7	45.6	54.0	8.4
3269.30	-1.6	41.3	41.2	39.7	54.0	14.3
4904.00	0.4	42.2	43.9	44.3	54.0	9.7
6538.64	-7.4	58.1	52.7	50.7	54.0	3.3
7356.00	-5.5	38.1	38.8	33.3	54.0	20.7
9808.00	-1.8	36.6	35.5	34.8	54.0	19.2

[Restricted-band band-edge plot]

Horizontal Polarization

Vertical Polarization

Duty Cycle

11b 1Mbps	11g 18Mbps
	
11n-HT20 MSC10	**11n-HT40 MSC8**
	

	11b	11g	11n-HT20	11n-HT40
Txon	-	-	-	-
Txon + Txoff	-	-	-	-
Duty Cycle	1.00	1.00	1.00	1.00
Duty Cycle Factor (dB)	0.00	0.00	0.00	0.00

[Calculation method]

Duty Cycle = (Tx on) / (Tx on + Tx off)
Duty Cycle Factor (dB) = 10Log (1/Duty Cycle)

[Note]

(1) ☐ Correction Factor includes the antenna factor, cable loss, attenuator loss and pre-amplifier gain.
☒ Correction Factor includes the cable loss and attenuator loss.
Above 1000MHz, the antenna factor includes the cable loss, pre-amplifier gain and attenuator loss (if necessary).

(2) * mark in Measured Frequency : Measured with the tuned dipole antenna.
no mark in Measured Frequency : Measured with the broadband antenna.

(3) Upper Frequency : ☒Transmitter Frequency (TX): TX < 10GHz
☐1GHz ☒10th harmonic of the TX frequency / ☐Up to 40GHz
☐Transmitter Frequency (TX): 10GHz < TX < 30GHz
☐10th harmonic of the TX frequency / ☐Up to 100GHz
☐Transmitter Frequency (TX): 30GHz ≤ TX
☐10th harmonic of the TX frequency / ☐Up to 200GHz

The emissions were checked to the upper frequency, and the lower emissions than the listed emissions in the above tables were omitted.

(4) Measurement Distance : <below 1GHz> ☒ 3m ☐ 10m
<above 1GHz> ☒ 3m ☐ 10m
<above 18GHz> 1m

(5) Placement height of EUT : <below 1GHz> 0.8m
<above 1GHz> 1.5m

(6) Bore-sight method setting : horn antenna orientation was center of Turn Table

[Calculation method]

Maximum Field Strength (dBμV/m)
= Meter Reading (at maximum level of Horizontal or Vertical) (dBμV) + Correction Factor (dB/m) + Distance factor (*) + Duty Cycle Factor (dB) (Average measurement of above 1GHz) (**)

(*) Applied for Radiated Emission Measurement (above 18GHz) only.
Distance factor : 20 × log10 (1m /3m) = -9.5dB

(**) See page 41.

Tested Date	Environment	
	Temperature	Humidity
13 November 2017	19°C	45 %

Below 30MHz (Conducted measurement)

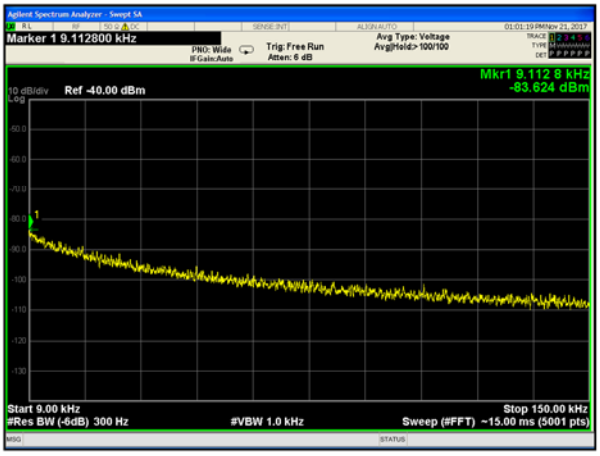
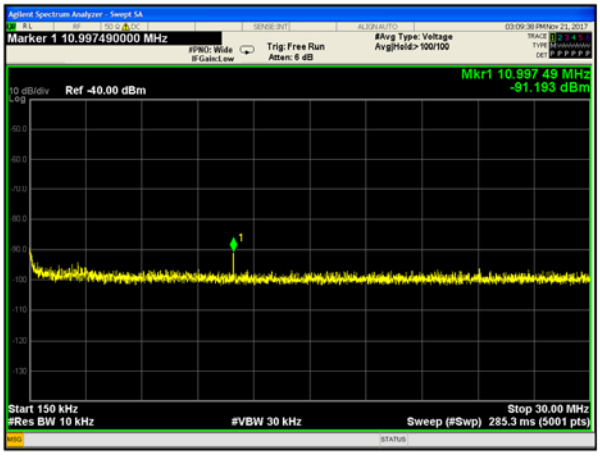
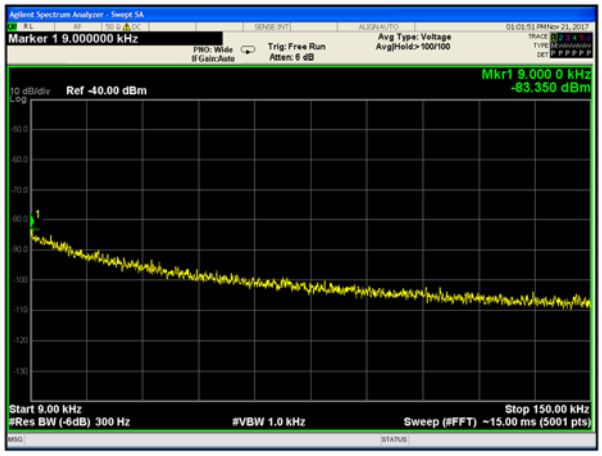
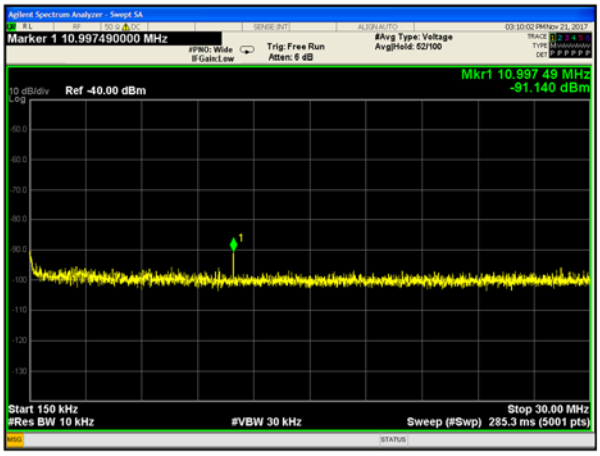
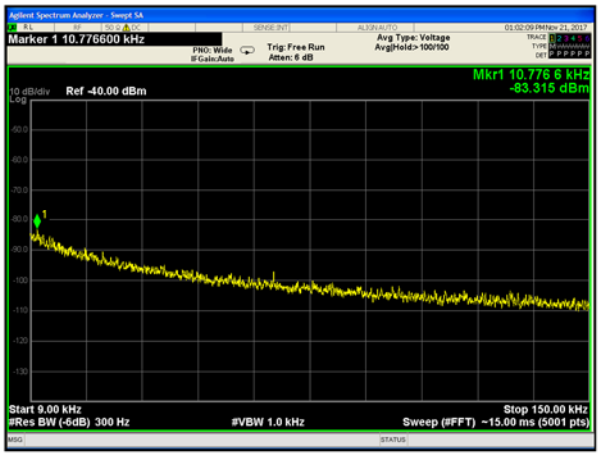
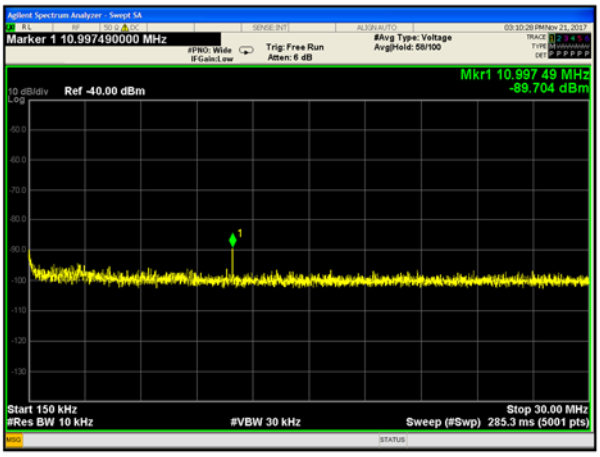
11b 2462MHz

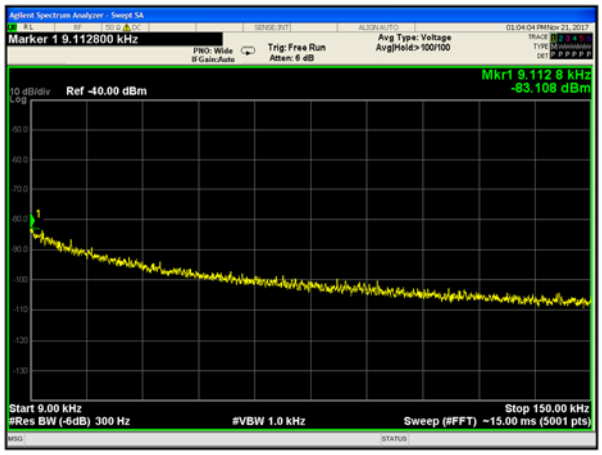
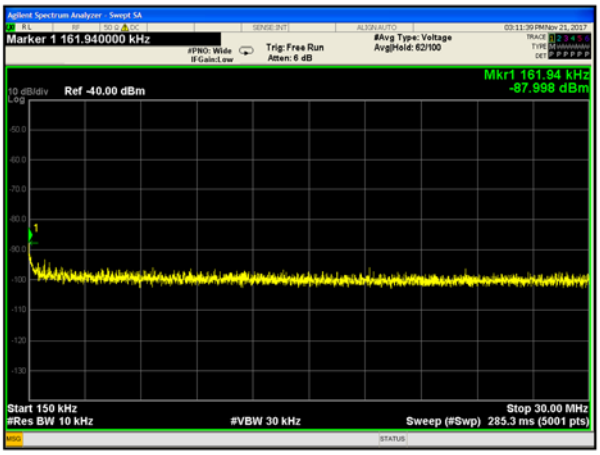
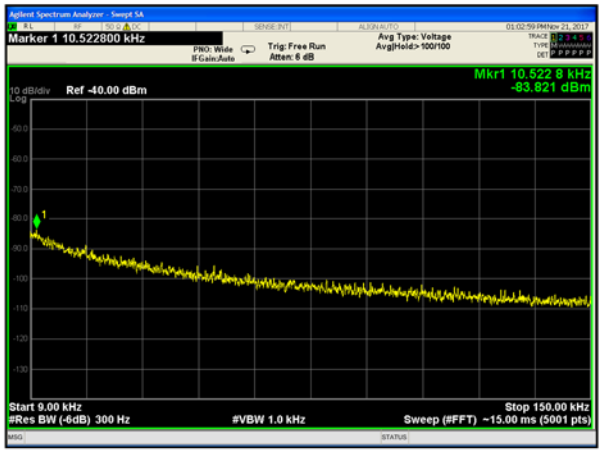
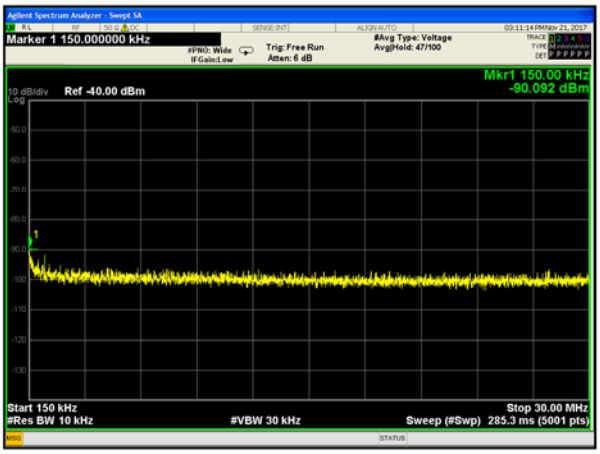
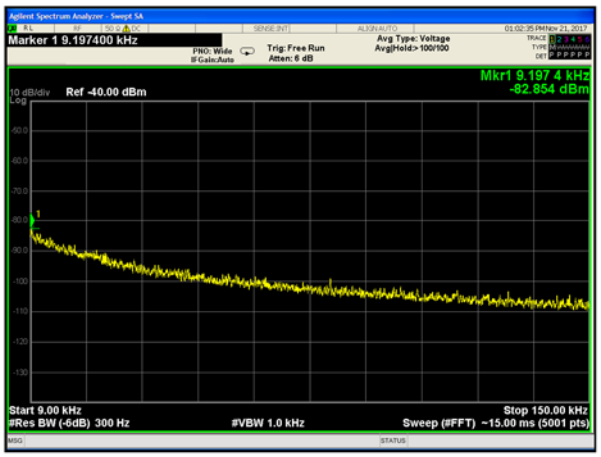
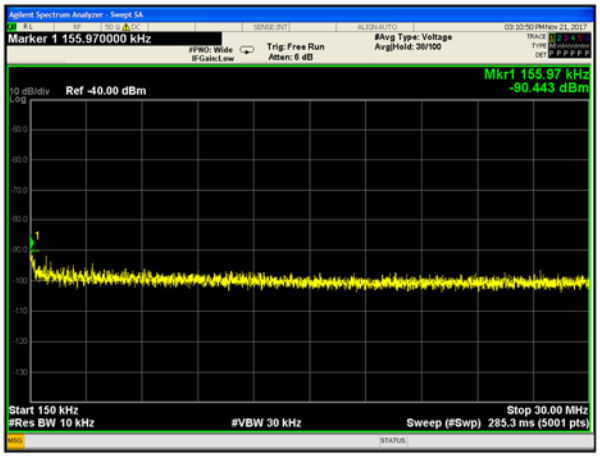
Measured Frequency (MHz)	Correction Factor (dB)	Meter Reading (dBm)	Ant Gain (dBi)	EIRP (dBm)	Distance (m)	Ground Bounce (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
10.997	9.87	-89.70	2.0	-77.83	30	6.00	3.43	29.54	26.11

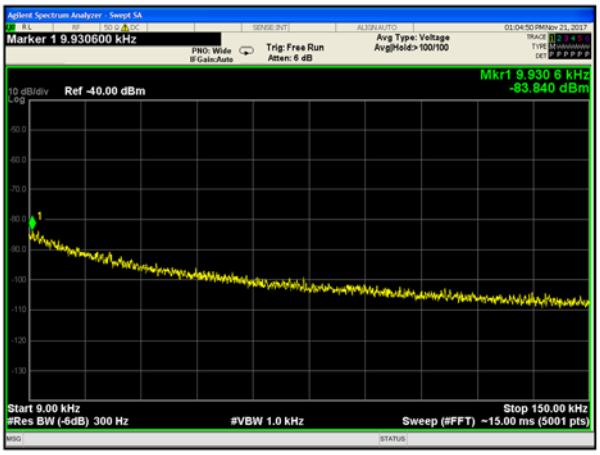
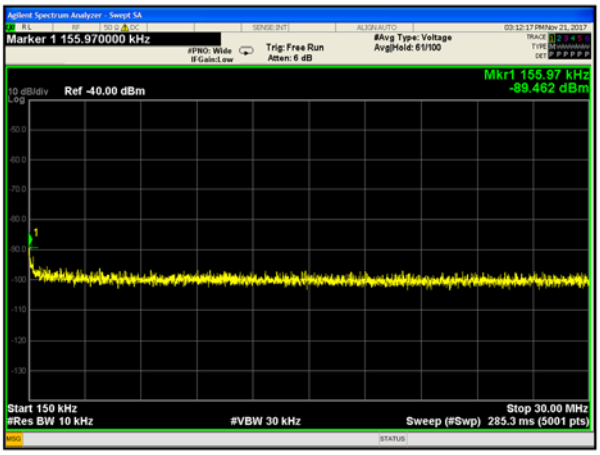
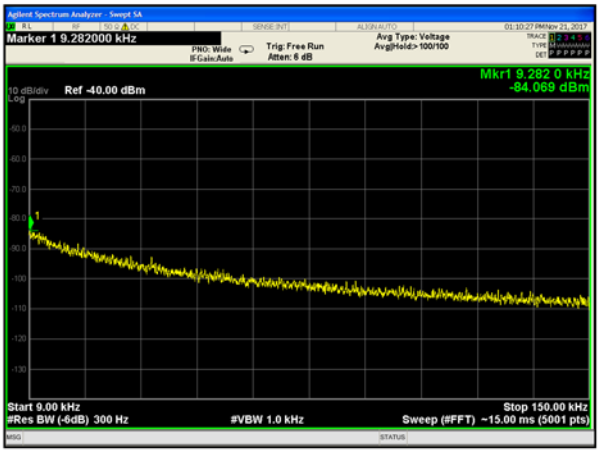
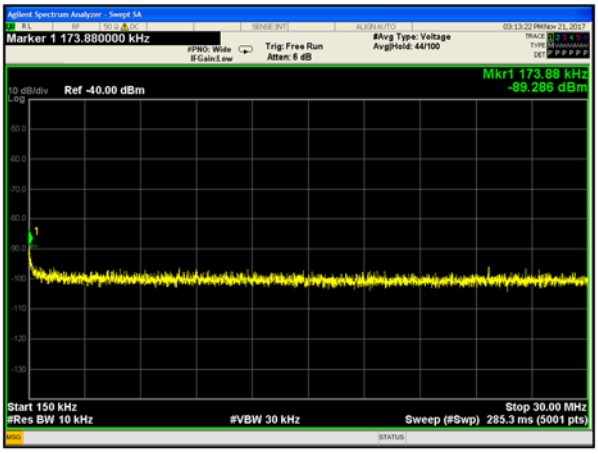
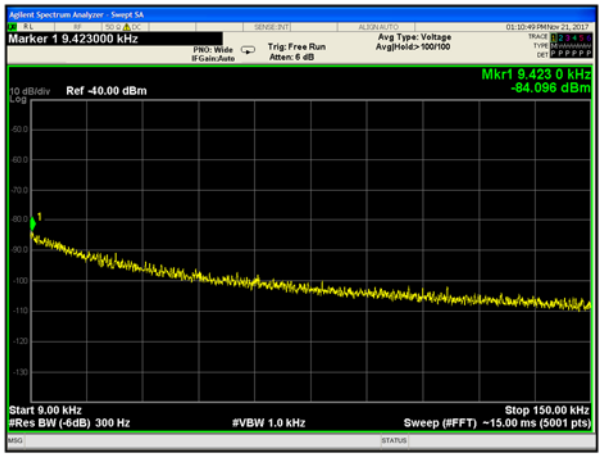
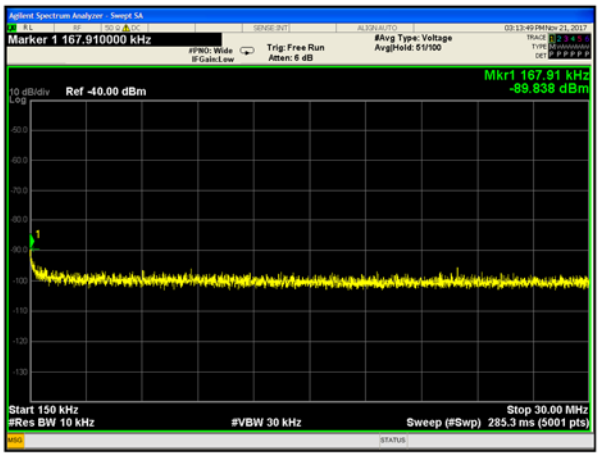
[Note]
(1) Correction Factor includes the cable loss and attenuator loss.
(2) See next page figure.
(3) Antenna gain was determined the maximum antenna gain or 2 dBi, whichever is greater, with reference to KDB558074.

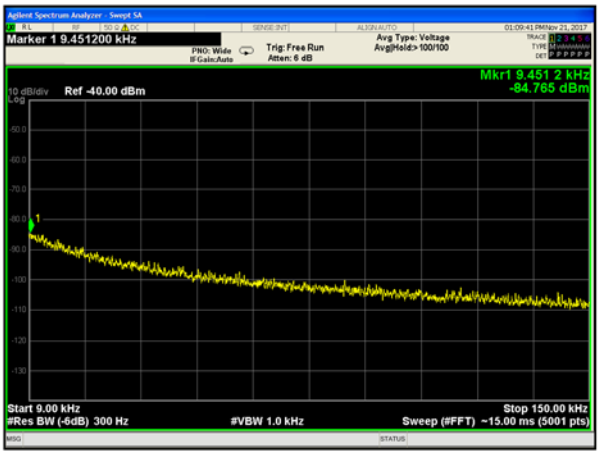
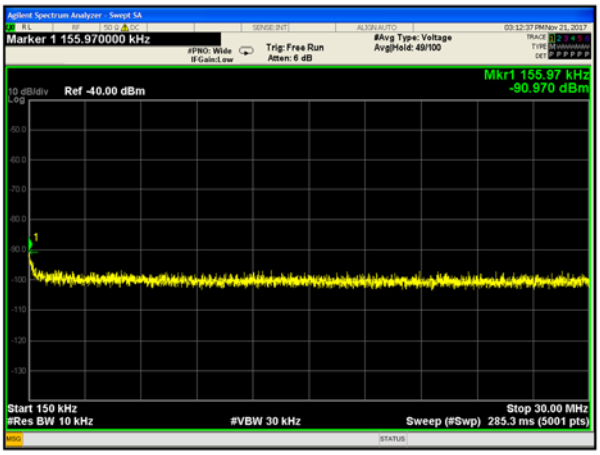
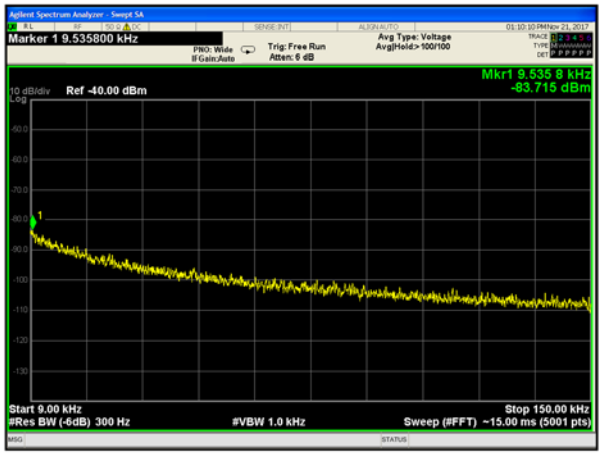
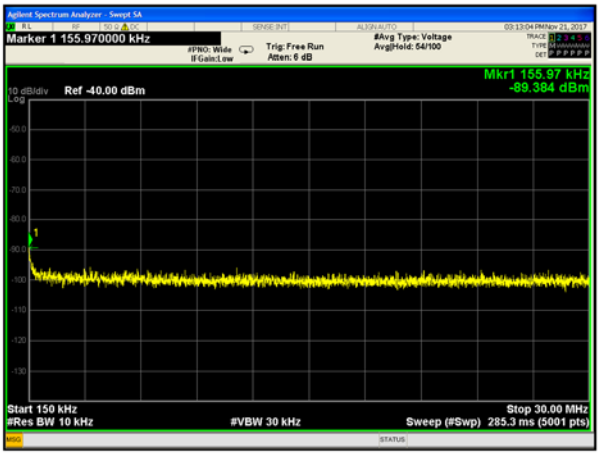
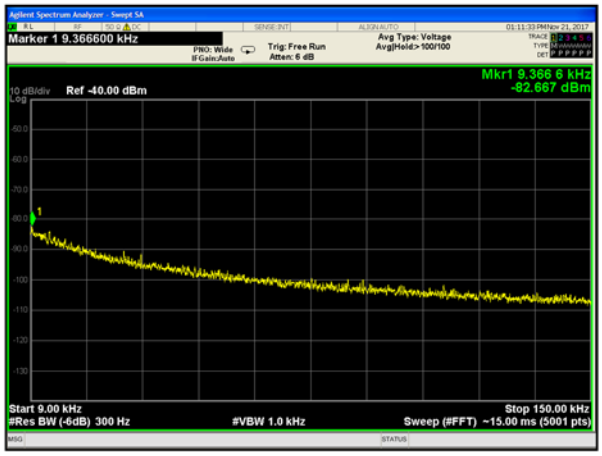
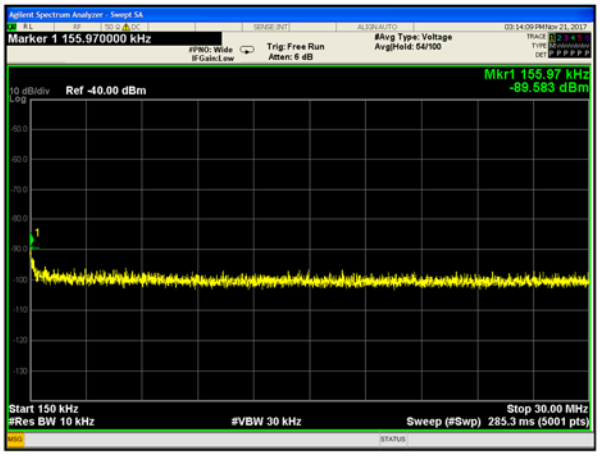
[Calculation method]
EIRP (dBm) = Meter Reading (dBm) + Correction Factor (dB) + Antenna Gain (dBi)
Field Strength (dBμV/m) = EIRP (dBm) - 20*log(D) + Ground Bounce (dB) + 104.8 (dBμV/m)

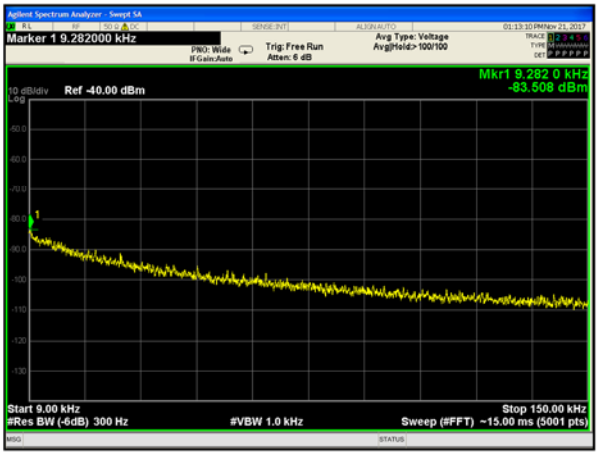
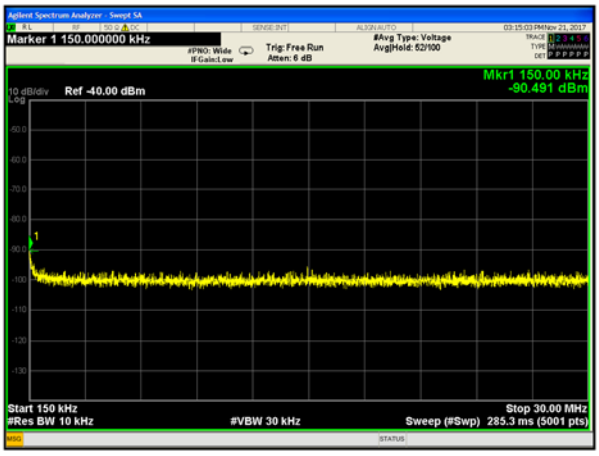
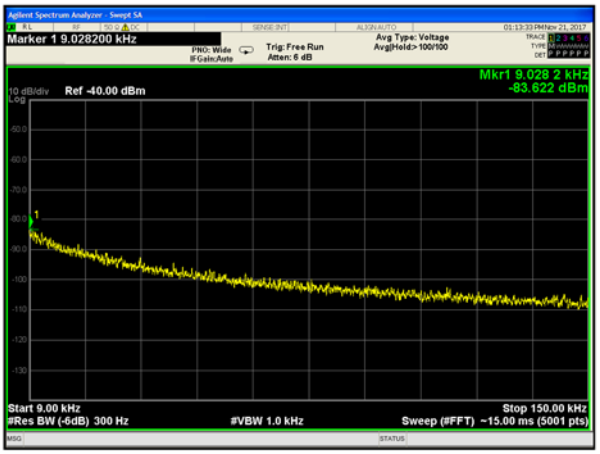
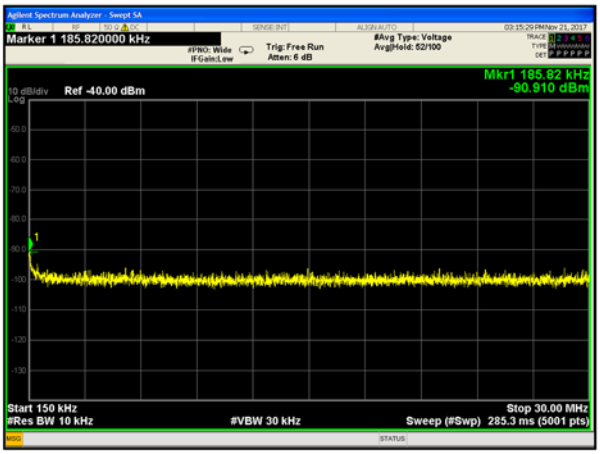
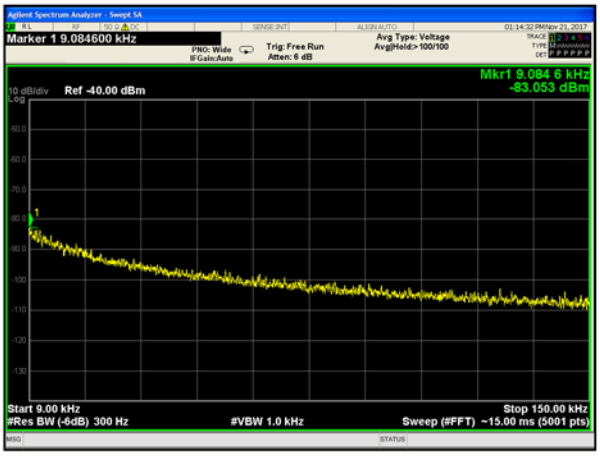
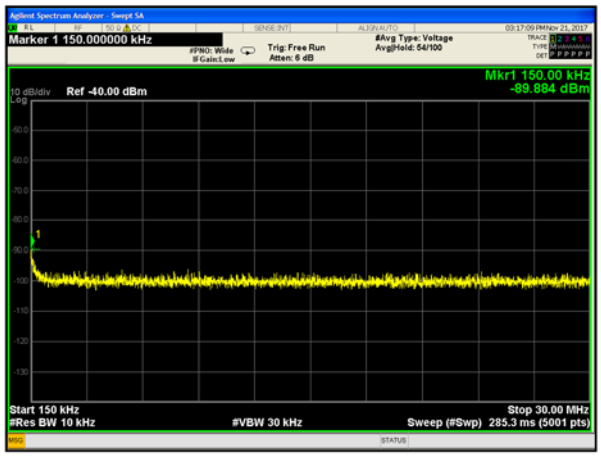
Tested Date	Environment	
	Temperature	Humidity
21 November 2017	22°C	36 %

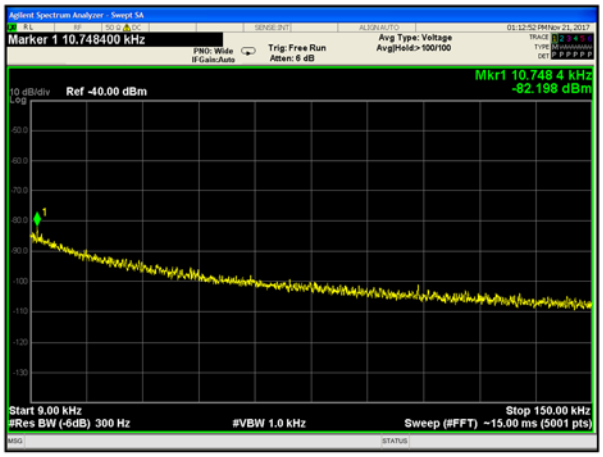
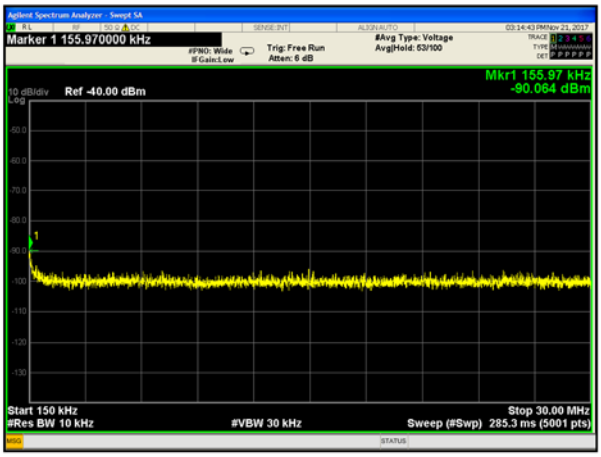
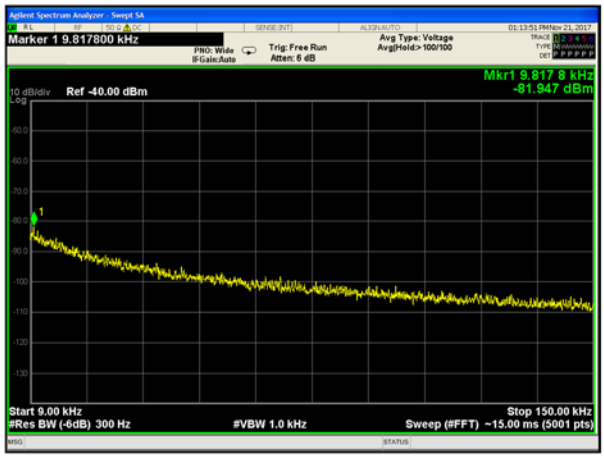
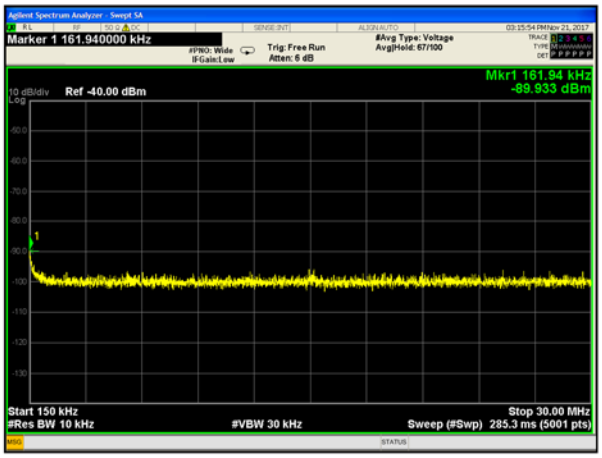
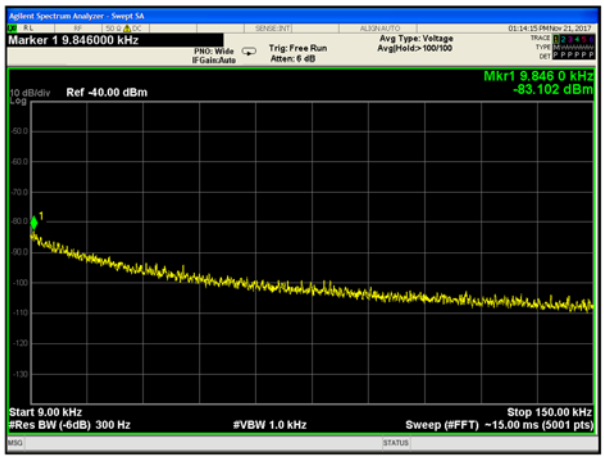
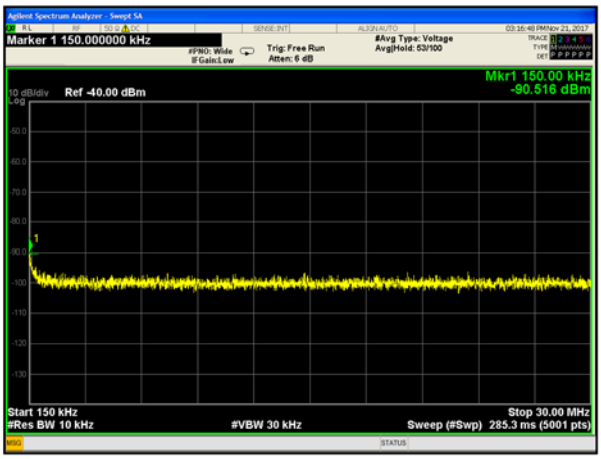
11b	
2412MHz	
9kHz-150kHz	150kHz-30MHz
	
2437MHz	
9kHz-150kHz	150kHz-30MHz
	
2462MHz	
9kHz-150kHz	150kHz-30MHz
	

11g	
2412MHz	
9kHz-150kHz	150kHz-30MHz
	
2437MHz	
9kHz-150kHz	150kHz-30MHz
	
2462MHz	
9kHz-150kHz	150kHz-30MHz
	

11n-HT20 Ant A	
2412MHz	
9kHz-150kHz	150kHz-30MHz
	
2437MHz	
9kHz-150kHz	150kHz-30MHz
	
2462MHz	
9kHz-150kHz	150kHz-30MHz
	

11n-HT20 Ant B	
2412MHz	
9kHz-150kHz	150kHz-30MHz
	
2437MHz	
9kHz-150kHz	150kHz-30MHz
	
2462MHz	
9kHz-150kHz	150kHz-30MHz
	

11n-HT40 Ant A	
2422MHz	
9kHz-150kHz	150kHz-30MHz
	
2437MHz	
9kHz-150kHz	150kHz-30MHz
	
2452MHz	
9kHz-150kHz	150kHz-30MHz
	

11n-HT40 Ant B	
2422MHz	
9kHz-150kHz	150kHz-30MHz
	
2437MHz	
9kHz-150kHz	150kHz-30MHz
	
2452MHz	
9kHz-150kHz	150kHz-30MHz
	

10. TEST EQUIPMENT

・Conducted Emission

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AT-144	Low Power Attenuator	HUBER+SUHNER	6810.01.A	2017/06	2018/06
FL-110	LISN	KYORITSU	KNW-242	2017/06	2018/06
MM-252	RF Relay Matrix	TSJ	RFM-E121	2017/06	2018/06
SA-067	Test Receiver	Keysight Technologies	N9038A	2017/09	2018/09

・Emission Bandwidth
・Peak Power Spectral Density

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AT-148	Fixed Attenuator	Anritsu	41KC-10	2017/04	2018/04
SA-065	Signal Analyzer	Agilent	N9030A	2016/12	2017/11

・Maximum Conducted Output Power

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AT-148	Fixed Attenuator	Anritsu	41KC-10	2017/04	2018/04
VV-061	Power Meter	Agilent	N1912A	2017/11	2018/11
VV-061-1	Wideband Power Sensor	Agilent	N1921A	2017/11	2018/11

・Spurious Emission (Radiated) 30-1000MHz

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AM-028	Pre-Amplifier	Anritsu	Anritsu	2017/04	2018/04
AN-094	Biconical Antenna	Schwarzbeck	VHA9103/BBA9106	2017/04	2018/04
AN-250	LPDA Antenna	Schwarzbeck	UHALP9108A	2017/04	2018/04
AT-159	Fixed Attenuator	Anritsu	MP721B	2017/04	2018/04
FS-099	Test Receiver	ROHDE & SCHWARZ	ESS	2017/01	2018/01
MM-530	RF Relay Matrix Unit	TSJ	RFM-E321	2017/04	2018/04
SA-059	Spectrum Analyzer	Agilent	N9010A	2017/07	2018/07

・Spurious Emission (Radiated) Above 1GHz

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AM-053	Pre-Amplifier	HP	8449B	2017/05	2018/05
AM-131	Pre-Amplifier	TOYO	TPA0118-36	2017/03	2018/03
AN-357	DRG Antenna	ETS LINDGREN	3117	2017/04	2018/04
AN-104	Std. Gain Horn Antenna	Scientific-Atlanta	12-5.8	2017/04	2020/04
AN-107	Std. Gain Horn Antenna	Scientific-Atlanta	12A-18	2017/05	2020/05
AN-145	Std. Gain Horn Antenna	Scientific-Atlanta	12-12	2017/04	2020/04
AN-210	Std. Gain Horn Antenna	Scientific-Atlanta	12-8.2	2017/04	2020/04
AN-337	DRG Horn Antenna	ETS LINDGREN	3117	2017/04	2018/04
AT-148	Fixed Attenuator	Anritsu	41KC-10	2017/04	2018/04
FL-222	Band-stop Filter	TOYO	8BRM2442/T300	2017/04	2018/04
FS-111	Test Receiver	ROHDE & SCHWARZ	ESW26	2017/03	2018/03
SA-065	Signal Analyzer	Agilent	N9030A	2016/12	2017/11

・Spurious Emission (Conducted) Below 30MHz

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AT-148	Fixed Attenuator	Anritsu	41KC-10	2017/04	2018/04
SA-067	Test Receiver	Keysight Technologies	N9038A	2017/09	2018/09

Note : (*1) KEC checked the performance, before using this device.

The overall program of calibration and verification of equipment is designed and operated so as to ensure that measurements made by KEC are traceable to the national standards of measurement or equivalent abroad.

APPENDIX A (DECLARATION OF COMPLIANCE TO MAXIMUM PERMISSIBLE EXPOSURE LIMITS FOR HUMANS)

The Model U9W31 with 2400-2483.5MHz transmitter complies with Maximum permissible exposure limits for humans as called out in §1.1310. It is exempt from Maximum Permissible Exposure based on its operating frequency, and power density 0.058mW/cm^2.

Calculation formula :

$$S = PG / 4\pi D^2$$

S : power density (W/m^2)
P : peak output power (W)
G : antenna gain (isotropic)
D : measurement distance (m)

Where :
・Ant A
P = 21.24dBm at 2452 MHz, 11n-HT40 (see 20 page)
G = 0.67dBi
・Ant B
P = 20.61dBm at 2452 MHz, 11n-HT40 (see 20 page)
G = 0.88dBi
・D = 0.2m

Therefore :

$$S(W/m^2) = \frac{(10^{\frac{21.24}{10}} \times 10^{-3} \times 10^{\frac{0.67}{10}}) + (10^{\frac{20.61}{10}} \times 10^{-3} \times 10^{\frac{0.88}{10}})}{4 \times \pi \times 0.2 \times 0.2} = 0.58$$

S≒0.058 (mW/cm^2)

This would be less than 1mW/cm^2 when the separation distance between the user and the device's radiating element is no less than 20cm.