RADIO TEST REPORT

Test Report No. : 13408006H-A-R2

Applicant	:	**DENSO CORPORATION**
Type of Equipment	:	**Millimeter Wave Radar Sensor**
Model No.	:	**DNMWR011**
Test regulation	:	**FCC Part 95 Subpart M: 2017**
FCC ID	:	**HYQDNMWR011**
Test Result	:	**Complied (Refer to SECTION 3.2)**

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3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in Section 1.
10 This report is a revised version of 13408006H-A-R1. 13408006H-A-R1 is replaced with this report.

Date of test: July 20 to September 7, 2020

Representative test engineer:
Yuichiro Yamazaki
Engineer
Consumer Technology Division

Approved by:
Tsubasa Takayama
Leader
Consumer Technology Division

CERTIFICATE 5107.02

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 13408006H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13408006H-A	August 25, 2020	-	-
1	13408006H-A-R1	September 8, 2020	P.14	Addition of the following descriptive text in SECTION 5; The Peak Power results was applied to the desensitization correction factor by KDB653005 4.(c). The derivation of the FMCW Desensitization Factor is given in Keysight Application Note 5952 1039 Appendix B. Desensitization factor was calculated from follow equation. $\alpha = \frac{1}{\sqrt[4]{1+\left(\frac{2In(2)}{\pi}\right)^2\left(\frac{Fs}{Ts\,B^2}\right)^2}}$ And FMCW Desensitization factor = 20 Log (α) Where Fs = FMCW Sweep Width or Chirp Width Ts = FMCW Sweep Time B = -3dB bandwidth of Gaussian RBW Filter For the values of Fs, Ts and B, refer to Theory of Operation-Specification.
1	13408006H-A-R1	September 8, 2020	P.16	Addition of the following sentence under the data table; Since the transmitter signal is CW it is impractical to use a RBW setting of 1 - 5 % of the emission bandwidth since the emission bandwidth will be proportional to the RBW.
1	13408006H-A-R1	September 8, 2020	P.16, 18	Replacement of data by retest of CW ch1, ch2, ch3 for Occupied bandwidth test.
1	13408006H-A-R1	September 8, 2020	P.19, 22, 23	Replacement of data by retest of CW and FCM1 Average power for Radiated Power test.
1	13408006H-A-R1	September 8, 2020	P.19	Addition of the following sentence under the Radiated Power data; The derivation of the FMCW Desensitization Factor is given in Keysight Application Note 5952 1039 Appendix B.
1	13408006H-A-R1	September 8, 2020	P.77	Addition of Test equipment by retest.
2	13408006H-A-R2	September 14, 2020	P.1	Correction of the test date on the cover page.
2	13408006H-A-R2	September 14, 2020	P.19	Correction of the following Desensitization Factor value in Radiated Power; FCM1 Low: from 3.84 dB to 4.67 dB FCM1 Mid: from 3.84 dB to 4.68 dB FCM1 High: from 3.84 dB to 4.68 dB FCM2 ch1: from 4.92 dB to 5.36 dB FCM2 ch2: from 4.92 dB to 5.36 dB FCM2 ch3: from 4.92 dB to 5.36 dB

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation
AC	Alternating Current
AFH	Adaptive Frequency Hopping
AM	Amplitude Modulation
Amp, AMP	Amplifier
ANSI	American National Standards Institute
Ant, ANT	Antenna
AP	Access Point
ASK	Amplitude Shift Keying
Atten., ATT	Attenuator
AV	Average
BPSK	Binary Phase-Shift Keying
BR	Bluetooth Basic Rate
BT	Bluetooth
BT LE	Bluetooth Low Energy
BW	BandWidth
Cal Int	Calibration Interval
CCK	Complementary Code Keying
Ch., CH	Channel
CISPR	Comite International Special des Perturbations Radioelectriques
CW	Continuous Wave
DBPSK	Differential BPSK
DC	Direct Current
D-factor	Distance factor
DFS	Dynamic Frequency Selection
DQPSK	Differential QPSK
DSSS	Direct Sequence Spread Spectrum
EDR	Enhanced Data Rate
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EN	European Norm
ERP, e.r.p.	Effective Radiated Power
EU	European Union
EUT	Equipment Under Test
Fac.	Factor
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
Freq.	Frequency
FSK	Frequency Shift Keying
GFSK	Gaussian Frequency-Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
Hori.	Horizontal
ICES	Interference-Causing Equipment Standard
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
ILAC	International Laboratory Accreditation Conference
ISED	Innovation, Science and Economic Development Canada
ISO	International Organization for Standardization
JAB	Japan Accreditation Board
LAN	Local Area Network
LIMS	Laboratory Information Management System
MCS	Modulation and Coding Scheme
MRA	Mutual Recognition Arrangement
N/A	Not Applicable
NIST	National Institute of Standards and Technology
NS	No signal detect.
NSA	Normalized Site Attenuation
NVLAP	National Voluntary Laboratory Accreditation Program
OBW	Occupied Band Width
OFDM	Orthogonal Frequency Division Multiplexing
P/M	Power meter
PCB	Printed Circuit Board
PER	Packet Error Rate
PHY	Physical Layer
PK	Peak
PN	Pseudo random Noise
PRBS	Pseudo-Random Bit Sequence
PSD	Power Spectral Density
QAM	Quadrature Amplitude Modulation
QP	Quasi-Peak
QPSK	Quadri-Phase Shift Keying
RBW	Resolution Band Width
RDS	Radio Data System
RE	Radio Equipment
RF	Radio Frequency
RMS	Root Mean Square
RSS	Radio Standards Specifications
Rx	Receiving
SA, S/A	Spectrum Analyzer
SG	Signal Generator
SVSWR	Site-Voltage Standing Wave Ratio
TR	Test Receiver
Tx	Transmitting
VBW	Video BandWidth
Vert.	Vertical
WLAN	Wireless LAN

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	DENSO CORPORATION
Address	:	1-1, Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan
Telephone Number	:	+81-566-87-3637
Facsimile Number	:	+81-566-25-4683
Contact Person	:	Kazuya Wakita

The information provided from the customer is as follows;
- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type	:	Millimeter Wave Radar Sensor
Model Number	:	DNMWR011
Serial Number	:	Refer to Clause 4.2
Rating	:	DC 12 V (Car battery), DC 6 V to 16 V (Operating range)
Receipt Date	:	June 29, 2020
Country of Mass-production	:	Japan and United States of America
Condition	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab

2.2 Product Description

Model: DNMWR011 (referred to as the EUT in this report) is the 76.0 GHz - 77.0 GHz vehicle-mounted field disturbance sensor that is a millimeter wave fast chirp modulation (FCM) radar operating at 76.0 GHz - 77.0 GHz (Nominal: 76.5 GHz).

Radio Specification

Radio Type	:	Transceiver
Antenna Type	:	Microstrip array antenna
Antenna Connector	:	None (Internal Antenna)
Scanning Antenna (transmit)	:	Fixed beam
Usage location	:	Vehicle-mounted
Clock Frequency (maximum)	:	50 MHz (Crystal)
Radome loss	:	0.5 dB (Typ)

Mode	Frequency of Operation	Modulation	Emission Classification	Antenna gain
FCM1	76.3 GHz, 76.5 GHz, 76.7 GHz	FCM (Narrowband, Tx_N)	QXN	18.8 dBi
FCM2	76.5 GHz	FCM (Wideband, Tx_W)	QXN	14.1 dBi
CW	76.5 GHz	N/A	N0N	14.1 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 95 Subpart M
FCC Part 95 final revised on September 20, 2017

Title : FCC 47CFR Part95 - PERSONAL RADIO SERVICES
Subpart M - The 76-81 GHz Band Radar Service

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	**FCC:** N/A	**FCC:** N/A	N/A	N/A	*1)
Occupied bandwidth	**FCC:** ANSI C63.26-2015 5.4 Occupied bandwidth	**FCC:** Section 2.1049	See data.	Complied a)	Radiated
Radiated Power Modulation characteristics	**FCC:** ANSI C63.26-2015 5.5 Radiated emissions testing ANSI C63.10-2013 6. Standard test methods 9. Procedures for testing millimeter-wave systems	**FCC:** Section 95.3367 Section 2.1046 Section 2.1047		Complied b)	Radiated
Field strength of spurious radiation	**FCC:** ANSI C63.26-2015 5.5 Radiated emissions testing	**FCC:** Section 95.3379 (a) Section 2.1053 Section 2.1057	8.45 dB 230.763 GHz < FCM 1 Mid >	Complied c)	Radiated
Frequency stability	**FCC:** ANSI C63.26-2015 5.6 Frequency stability testing	**FCC:** Section 95.3379 (b) Section 2.1055	See data.	Complied d)	Radiated

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

a) Refer to APPENDIX 1 (data of Occupied bandwidth)
b) Refer to APPENDIX 1 (data of Radiated Power and Modulation characteristics)
c) Refer to APPENDIX 1 (data of Field strength of spurious radiation)
d) Refer to APPENDIX 1 (data of Frequency Stability)

Symbols:
Complied The data of this test item has enough margin, more than the measurement uncertainty.
Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

* In case any questions arise about test procedure, ANSI C63.26-2015 and C63.10-2013 are also referred.

Supplied Voltage Information
This EUT provides stable voltage constantly to RF Module regardless of input voltage.

Antenna Information
The antenna is not removable from the EUT.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.

Ise EMC Lab.

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz - 0.15 MHz	2.9 dB
0.15 MHz - 30 MHz	3.4 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3 m	3.3 dB
10 m	3.2 dB

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	5.0 dB	6.3 dB	4.8 dB	5.0 dB

Radiated emission (Above 1 GHz)					
(3 m*) (+/-)		(1 m*) (+/-)		(0.5 m*) (+/-)	(10 m*) (+/-)
1 GHz - 6 GHz	6 GHz - 18 GHz	10 GHz - 26.5 GHz	26.5 GHz - 40 GHz	26.5 GHz - 40 GHz	1 GHz - 18 GHz
4.9 dB	5.2 dB	5.5 dB	5.5 dB	5.5 dB	5.2 dB

*Measurement distance

Radiated emission	Uncertainty [+/- dB]	Distance
40 GHz - 50 GHz	3.9	>= 0.5 m
50 GHz - 75 GHz	5.3	>= 0.5 m
75 GHz - 110 GHz	5.6	>= 0.5 m
110 GHz - 170 GHz	4.7	>= 3.8 cm*
170 GHz - 260 GHz	4.5	>= 2.5 cm*

*under consideration about Uncertainty for testing at 1 cm distance

Radiated Emission (with Block downconverter)	Uncertainty [+/- dB]	Distance
75 GHz - 83 GHz	4.5*	>= 0.5 m

* This value was used for 75 GHz - 83 GHz in this report.

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

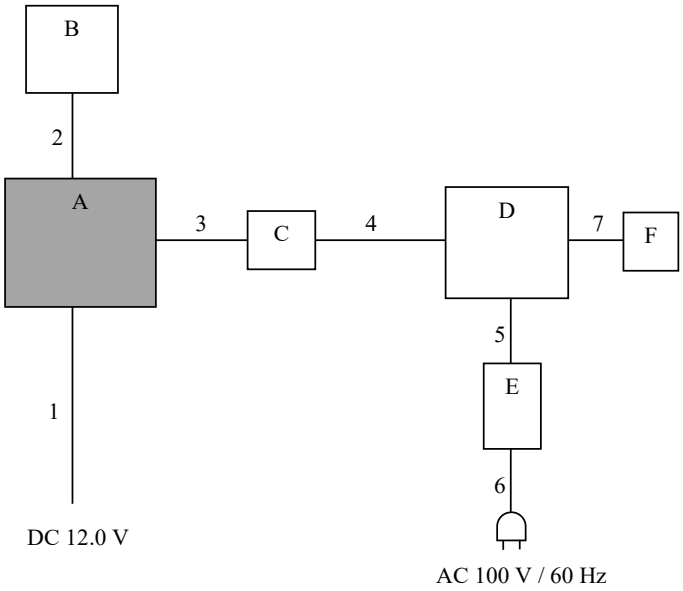
Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Mode	Test Item
Transmitting mode (Tx) - FCM 1 Low (76.3 GHz) - FCM 1 Mid (76.5 GHz) - FCM 1 High (76.7 GHz) - FCM 2 ch 1 - FCM 2 ch 2 - FCM 2 ch 3 - CW ch 1 - CW ch 2 - CW ch 3	Occupied bandwidth Radiated Power Duty Frequency stability
Transmitting mode (Tx) - FCM 1 Low (76.3 GHz) - FCM 1 Mid (76.5 GHz) - FCM 1 High (76.7 GHz) - FCM 2 ch 3 - CW ch 2	Field strength of spurious radiation
Normal operating mode	Modulation characteristics
Power of the EUT was set by the software as follows; - Power setting : Same as production model - Software : mwr_gen6_0064_3420 - Tool : Gen6_Inspection Program Ver.3.0.0 This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

4.2 Configuration and peripherals



* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Millimeter Wave Radar Sensor	DNMWR011	VINV-2085	DENSO CORPORATION	EUT
B	Dummy Load	3164330-3	-	-	-
C	CAN Interface	VN1610	007150-043652	vector	*1)
D	Laptop PC	z0003101024	00329-10130-03275-AA040	TOSHIBA	*1)
E	AC Adaptor	PA5044U-1ACA	G71C000E6410 0302895	TOSHIBA	*1)
F	Mouse	M-U0026	1846HS01X088	Logitec	*1)

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	2.0	Unshielded	Unshielded	-
2	DC Cable	0.7	Unshielded	Unshielded	-
3	CAN Cable	2.4	Unshielded	Unshielded	-
4	USB Cable	1.0	Shielded	Shielded	*1)
5	DC Cable	1.7	Unshielded	Unshielded	*1)
6	AC Cable	0.9	Unshielded	Unshielded	*1)
7	USB Cable	1.6	Shielded	Shielded	*1)

*1) Used for other tests except for Field strength of spurious radiation test.

SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]
EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz, up to 40 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 m and 4 m (frequency range 9 kHz - 30 MHz: loop antenna was fixed height at 1.0 m) and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear voltage average mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

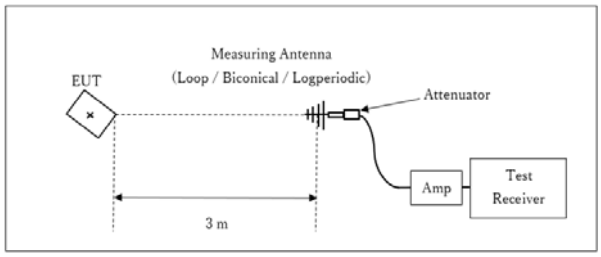
Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

Frequency	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 1 GHz	1 GHz to 40 GHz
Instrument used	Test Receiver	Test Receiver	Test Receiver	Spectrum Analyzer
Detector	CISPR QP, Average	CISPR QP, Average	CISPR QP	Average *1)
IF Bandwidth	200 Hz	9 kHz	120 kHz	RBW: 1 MHz VBW: 3 MHz

*1) An RMS average mode was used: 1 ms or less averaging time (integration time period for each spectrum analyzer bin; spectrum analyzer sweeptime / number-of-bins not exceeding one millisecond)

[Test setup]

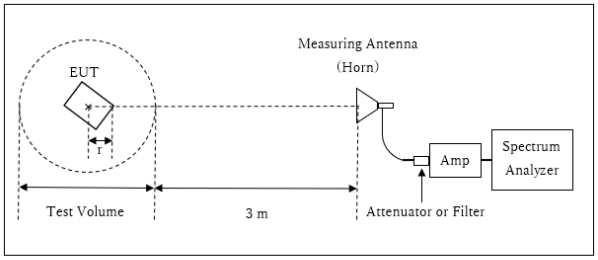
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



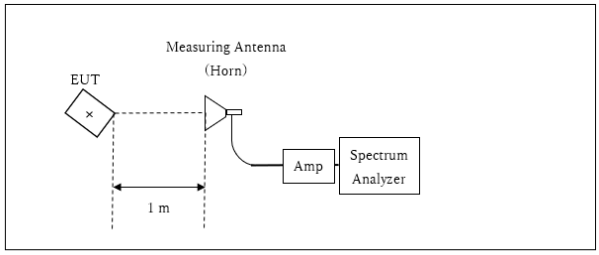
r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (4.0 m*/3.0 m) = 2.50 dB
* Test Distance: (3 + Test Volume /2) - r = 4.0 m

Test Volume: 2 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.0 m

* The test was performed with r = 0.0 m since that yielded the worst emission levels from the EUT.

10 GHz - 26.5 GHz



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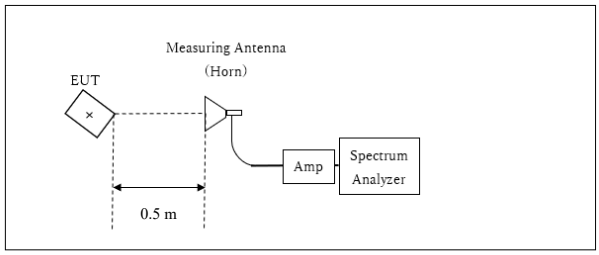
Distance Factor: 20 x log (1.0 m* / 3.0 m) = -9.54 dB
*Test Distance: 1 m

26.5 GHz - 40 GHz



× : Center of turn table

Distance Factor: 20 x log (0.5 m* / 3.0 m) = -15.56 dB
*Test Distance: 0.5 m

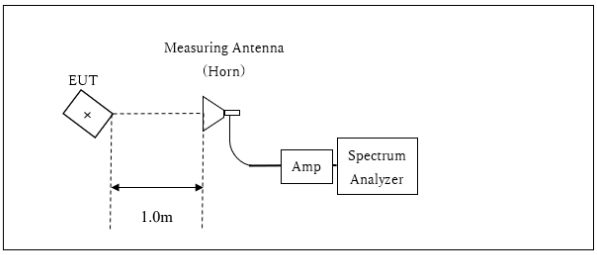
[Above 40 GHz]
The test was performed based on "Procedures for testing millimeter-wave systems" of ANSI C63.10-2013. The EUT was placed on a urethane platform, raised 1.5 m above the conducting ground plane. The measurements were performed on handheld method.

Set spectrum analyzer RBW, VBW, span, etc., to the proper values. Note these values. Enable two traces—one set to "clear write," and the other set to "max hold." Begin hand-held measurements with the test antenna (horn) at a distance of 1 m from the EUT in a horizontally polarized position. Slowly adjust its position, entirely covering the plane 1 m from the EUT. Observation of the two active traces on the spectrum analyzer will allow refined horn positioning at the point(s) of maximum field intensity. Repeat with the horn in a vertically polarized position. If the emission cannot be detected at 1 m, reduce the RBW to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.

Note the maximum level indicated on the spectrum analyzer. Adjust this level, if necessary, by the antenna gain, conversion loss of the external mixer and gain of LNA used, at the frequency under investigation. Calculate the field strength of the emission at the measurement distance from the Friis' transmission equation.

Frequency	40 GHz to 50 GHz	50 GHz to 76 GHz	81 GHz to 83 GHz	83 GHz to 110 GHz	110 GHz to 170 GHz	170 GHz to 231 GHz
Final measurement distance with 1 MHz Peak detector	1.0 m	1.0 m	0.5 m	1.0 m	0.01 m	0.01 m

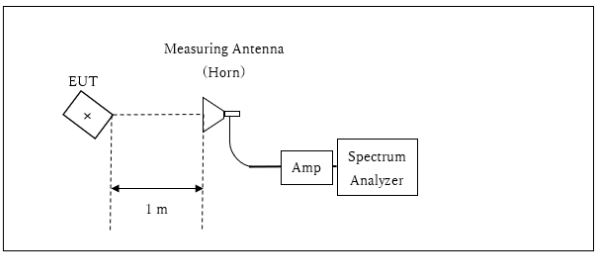
[Test setup]
40 GHz - 76 GHz, 83 GHz - 110 GHz



× : Center of turn table

*Test Distance: 1.0 m

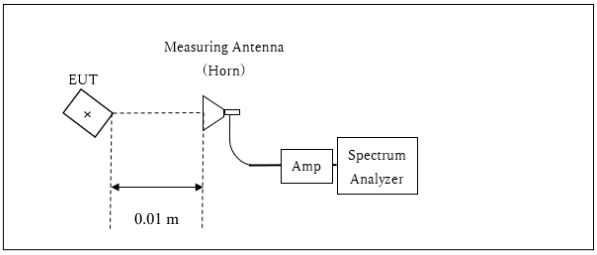
81 GHz - 83 GHz



× : Center of turn table

*Test Distance: 0.5 m

110 GHz - 231 GHz



× : Center of turn table

*Test Distance: 0.01 m

[About fundamental measurement]
The carrier levels were confirmed at maximum direction of transmission. The maximum direction was searched under carefully since beam-widths are extremely narrow.

The carrier levels were measured in the far field. The distance of the far field was calculated from follow equation.

$$r = \frac{2D^2}{\lambda}$$

where

r is the distance from the radiating element of the EUT to the edge of the far field, in m
D is the largest dimension of both the radiating element and the test antenna (horn), in m
(The antenna aperture size of test antenna was used for this caluculation.)
Lambda is the wavelength of the emission under investigation [300/f (MHz)], in m

Frequency	Wavelength	Maximum Dimention			Far Field
		EUT	Test Antenna	Maximum	Boundary
	Lambda			*D*	*r*
[GHz]	[mm]	[m]	[m]	[m]	[m]
77.0	3.9	0.018500	0.025150	0.025150	0.325

- The carrier level and noise levels were confirmed at each position of X, Y axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise
The test results and limit are rounded off to one decimal place, so some differences might be observed.

The Peak Power results was applied to the desensitization correction factor by KDB653005 4.(c).
The derivation of the FMCW Desensitization Factor is given in Keysight Application Note 5952 1039 Appendix B.

Desensitization factor was calculated from follow equation.

$$\alpha = \frac{1}{\sqrt[4]{1 + \left(\frac{2In(2)}{\pi}\right)^2 \left(\frac{Fs}{Ts\,B^2}\right)^2}}$$

And
FMCW Desensitization factor = 20 Log (α)

Where
Fs = FMCW Sweep Width or Chirp Width
Ts = FMCW Sweep Time
B = -3dB bandwidth of Gaussian RBW Filter

For the values of Fs, Ts and B, refer to Theory of Operation-Specification.

Measurement range : 9 kHz - 231 GHz
Test data : APPENDIX
Test result : Pass

SECTION 6: Frequency Stability

Test Procedure
The block downconverter was placed in side of the temperature chamber's drain hole.

The power supply was set to nominal operating voltage (100 %), and the spectrum mask was measured at 20 deg. C. After that, EUT power supply was varied between 85 % and 115 % of nominal voltage and the frequency excursion of the EUT emission mask was recorded.

The EUT operating temperature was raised to 50 deg. C, and the frequency excursion of the EUT emission mask was recorded. Measurements were repeated at each 10 deg. C decrement down to -20 deg. C.

Both lower and upper frequencies of the 99 % OBW were recorded.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Occupied bandwidth

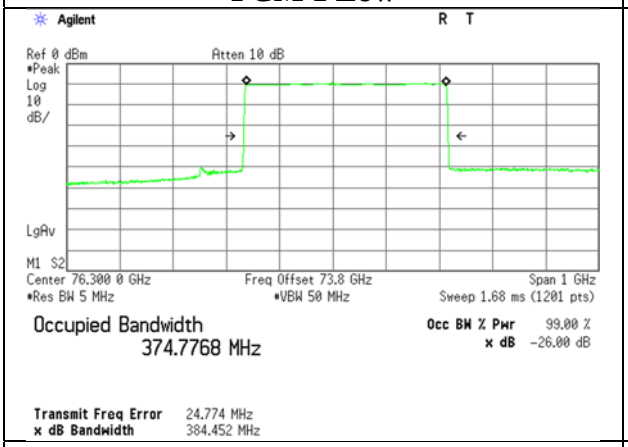
Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.1
Date	July 30, 2020	August 20, 2020	September 7, 2020
Temperature / Humidity	22 deg. C / 63 % RH	23 deg. C / 60 % RH	22 deg. C / 63 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
Mode	Tx		

Mode	Frequency [GHz]	99 % Occupied bandwidth [MHz]
FCM 1 Low	76.3	374.7768
FCM 1 Mid	76.5	375.5447
FCM 1 High	76.7	375.5435
FCM 2 ch 1	76.5	893.6882
FCM 2 ch 2	76.5	893.4071
FCM 2 ch 3	76.5	893.3745
CW ch 1	76.5	32.0099
CW ch 2	76.5	14.1786
CW ch 3	76.5	9.1907

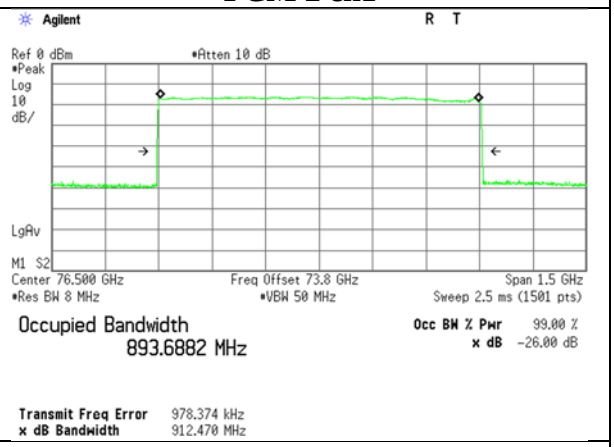
*Since the transmitter signal is CW it is impractical to use a RBW setting of 1 - 5 % of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

Occupied bandwidth

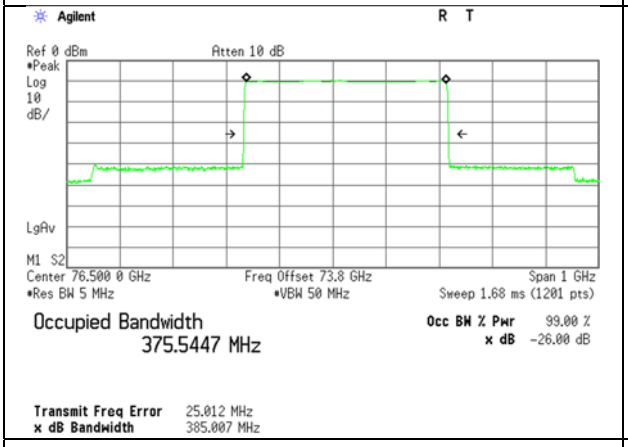
FCM 1 Low



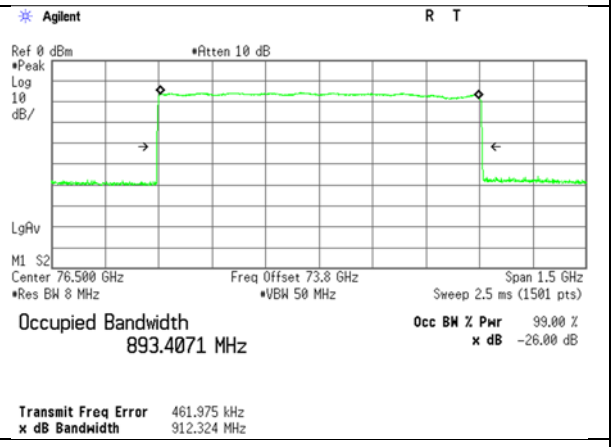
FCM 2 ch1



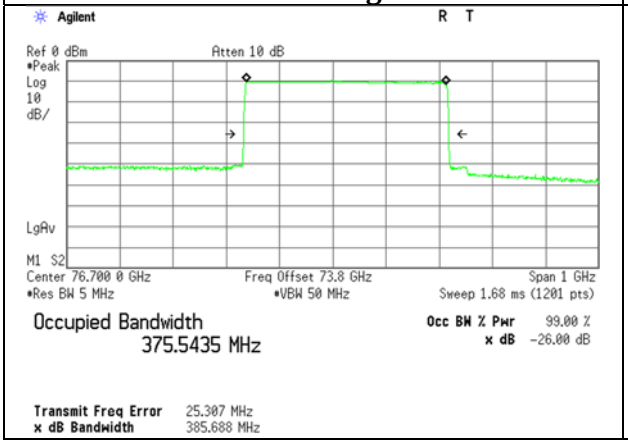
FCM 1 Mid



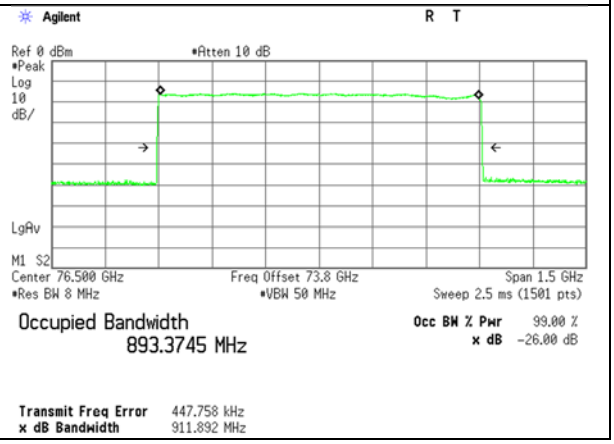
FCM 2 ch2



FCM 1 High



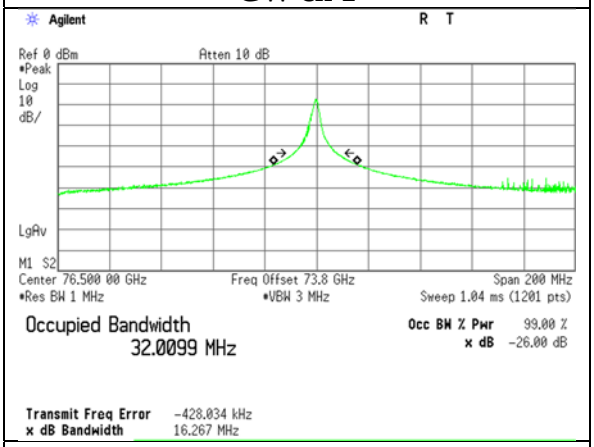
FCM 2 ch3



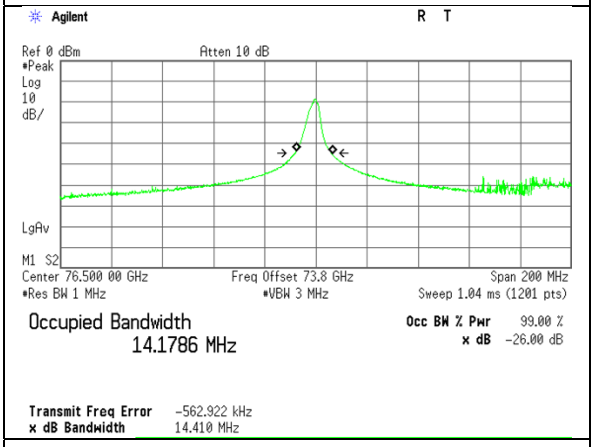
The measurement was performed with Peak detector and Max Hold since the duty cycle was not 100 %.

Occupied bandwidth

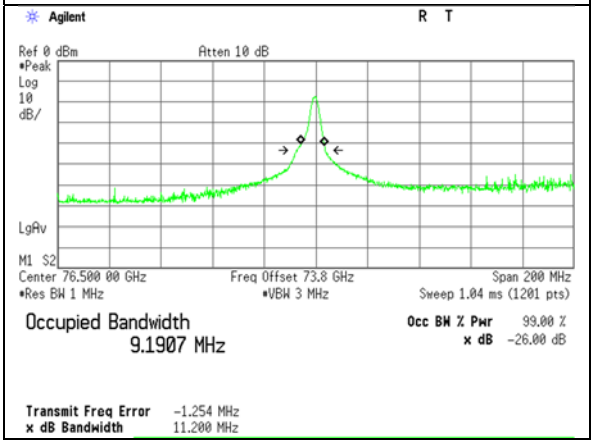
CW ch 1



CW ch 2



CW ch 3



The measurement was performed with Peak detector and Max Hold since the duty cycle was not 100 %.

Radiated Power

Report No.	13408006H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.1
Date	July 30, 2020	September 7, 2020
Temperature / Humidity	22 deg. C / 63 % RH	22 deg. C / 63 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki
Mode	Tx	

Measured data in Test modes

Mode	Power	Freq. [GHz]	Measured Power [dBm]	Tested Distance [m]	Rx Antenna Gain [dBi]	Down Converter Gain [dB]	IF Cable Loss [dB]	FSL [dB]	EIRP [dBm]	EIRP [mW]
FCM 1	Average	76.3	-17.17	1.5	23.05	14.72	1.35	73.61	20.02	100.56
Low	Peak	76.3	-9.21	1.5	23.05	14.72	1.35	73.61	27.98	628.65
FCM 1	Average	76.5	-17.17	1.5	23.06	14.76	1.40	73.64	20.05	101.08
Mid	Peak	76.5	-10.70	1.5	23.06	14.76	1.40	73.64	26.52	448.42
FCM 1	Average	76.7	-17.40	1.5	23.06	14.80	1.45	73.66	19.85	96.59
High	Peak	76.7	-9.80	1.5	23.06	14.80	1.45	73.66	27.45	555.84
FCM 2	Average	76.5	-42.92	1.5	23.06	14.76	1.40	73.64	-5.70	0.27
ch 1	Peak	76.5	-18.82	1.5	23.06	14.76	1.40	73.64	18.40	69.13
FCM 2	Average	76.5	-42.70	1.5	23.06	14.76	1.40	73.64	-5.48	0.28
ch 2	Peak	76.5	-18.31	1.5	23.06	14.76	1.40	73.64	18.91	77.75
FCM 2	Average	76.5	-42.55	1.5	23.06	14.76	1.40	73.64	-5.33	0.29
ch 3	Peak	76.5	-18.23	1.5	23.06	14.76	1.40	73.64	18.99	79.19
CW	Average	76.5	-23.07	1.5	23.06	14.76	1.40	73.64	14.15	25.98
ch 1	Peak	76.5	-18.29	1.5	23.06	14.76	1.40	73.64	18.93	78.11
CW	Average	76.5	-23.02	1.5	23.06	14.76	1.40	73.64	14.20	26.28
ch 2	Peak	76.5	-18.27	1.5	23.06	14.76	1.40	73.64	18.95	78.47
CW	Average	76.5	-23.54	1.5	23.06	14.76	1.40	73.64	13.68	23.32
ch 3	Peak	76.5	-18.31	1.5	23.06	14.76	1.40	73.64	18.91	77.75

Calculating formula:

FSL (Free Space path Loss) = 10 * log10((4 * Pi * Tested Distance / Lambda) ^2)

EIRP = Measured Power - Rx Antenna Gain - Down Converter Gain + IF Cable Loss + FSL

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.

Final result in Test modes

Mode	Power	EIRP Spectrum Analyzer [dBm]	Duty Factor [dB]	desensitization Factor [dB]	Result [mW]	Result [dBm]	Limit [dBm]	Margin [dB]
FCM 1	Average	20.02	4.44	-	279.52	24.46	50	25.54
Low	Peak	27.98	-	4.67	1843.27	32.66	55	22.34
FCM 1	Average	20.05	4.44	-	280.98	24.49	50	25.51
Mid	Peak	26.52	-	4.68	1317.18	31.20	55	23.80
FCM 1	Average	19.85	4.44	-	268.50	24.29	50	25.71
High	Peak	27.45	-	4.68	1632.73	32.13	55	22.87
FCM 2	Average	-5.70	25.77	-	101.43	20.06	50	29.94
ch 1	Peak	18.40	-	5.36	237.48	23.76	55	31.24
FCM 2	Average	-5.48	25.77	-	106.70	20.28	50	29.72
ch 2	Peak	18.91	-	5.36	266.99	24.26	55	30.74
FCM 2	Average	-5.33	25.77	-	110.45	20.43	50	29.57
ch 3	Peak	18.99	-	5.36	271.95	24.34	55	30.66
CW	Average	14.15	4.95	-	81.26	19.10	50	30.90
ch 1	Peak	18.93	-	-	78.11	18.93	55	36.07
CW	Average	14.20	4.89	-	81.02	19.09	50	30.91
ch 2	Peak	18.95	-	-	78.47	18.95	55	36.05
CW	Average	13.68	4.83	-	70.87	18.50	50	31.50
ch 3	Peak	18.91	-	-	77.75	18.91	55	36.09

Calculating formula:

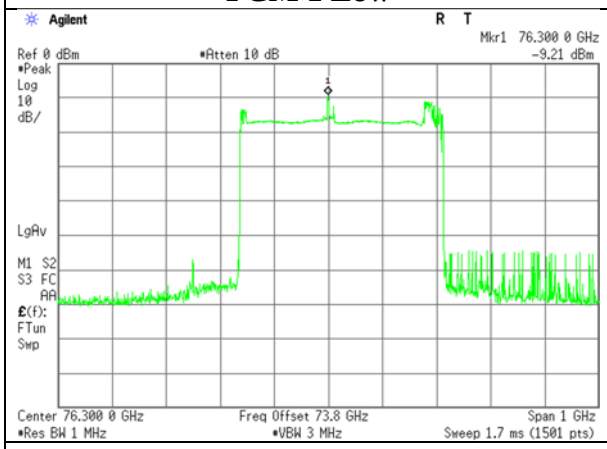
EIRP Result (Average) = EIRP(Spectrum Analyzer) + Duty Factor + Desensitization Factor

For the peak power result, it is a maximum power.
The test method referred to KDB653005.
The derivation of the FMCW Desensitization Factor is given in Keysight Application Note 5952 1039 Appendix B.

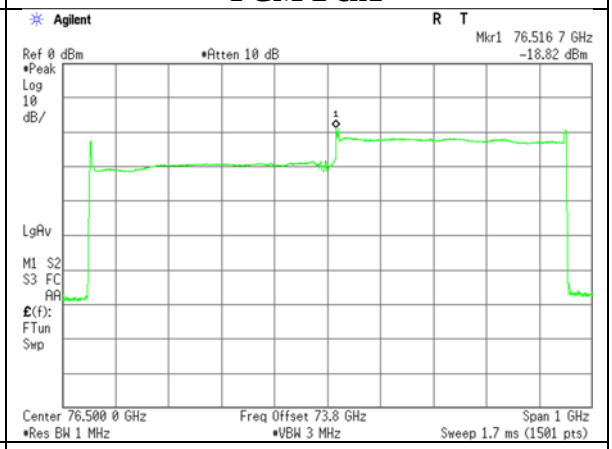
Radiated Power

Peak

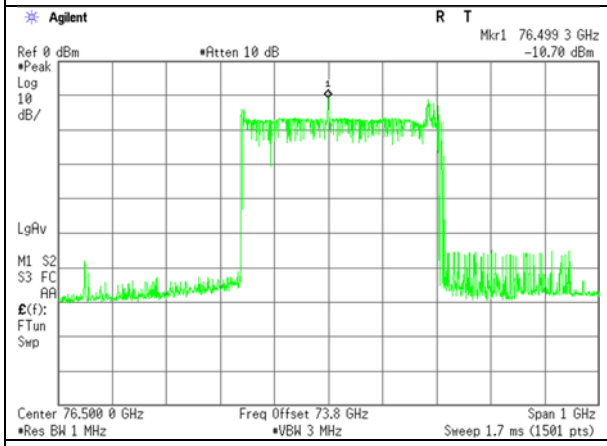
FCM 1 Low



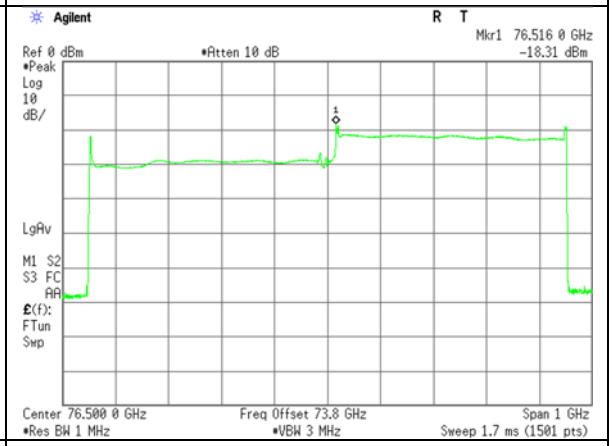
FCM 2 ch1



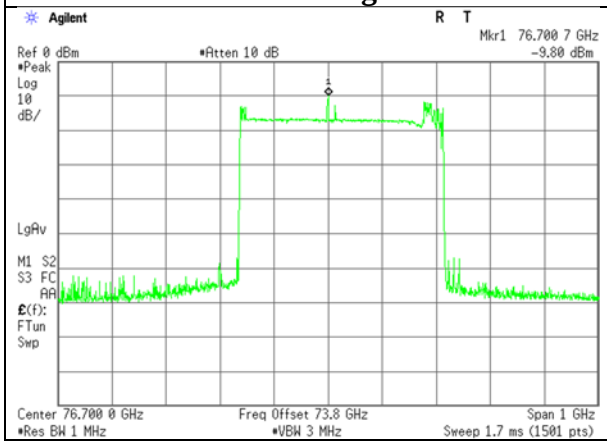
FCM 1 Mid



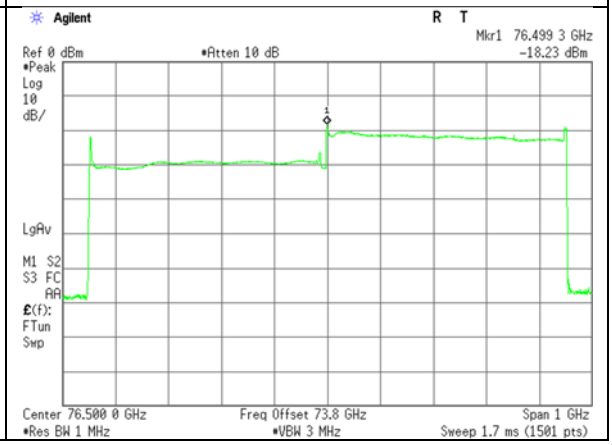
FCM 2 ch2



FCM 1 High



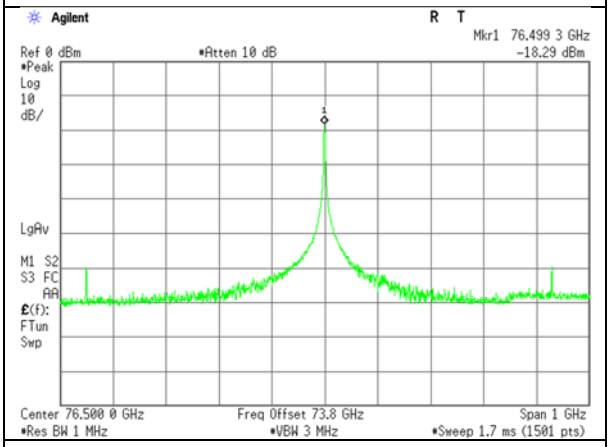
FCM 2 ch3



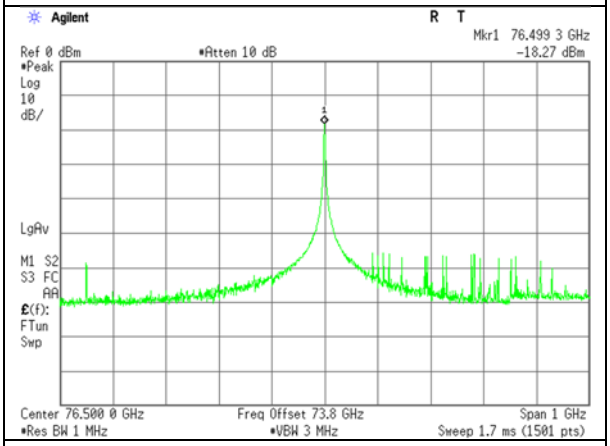
Radiated Power

Peak

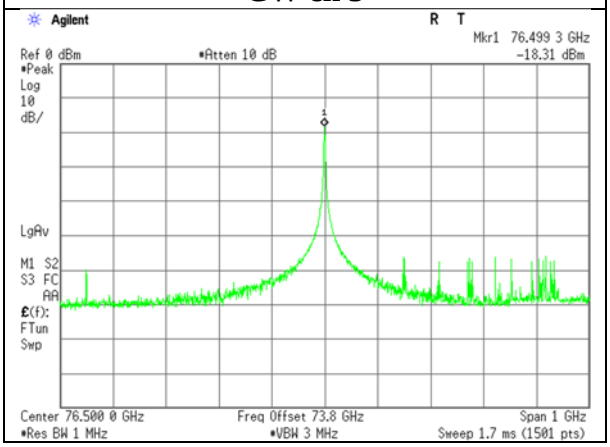
CW ch 1



CW ch 2



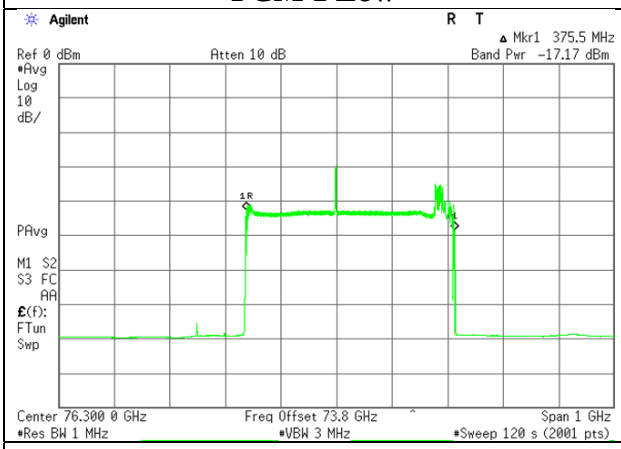
CW ch 3



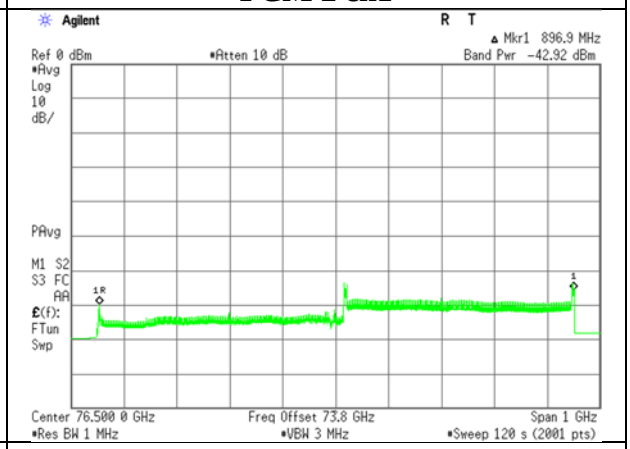
Radiated Power

Average

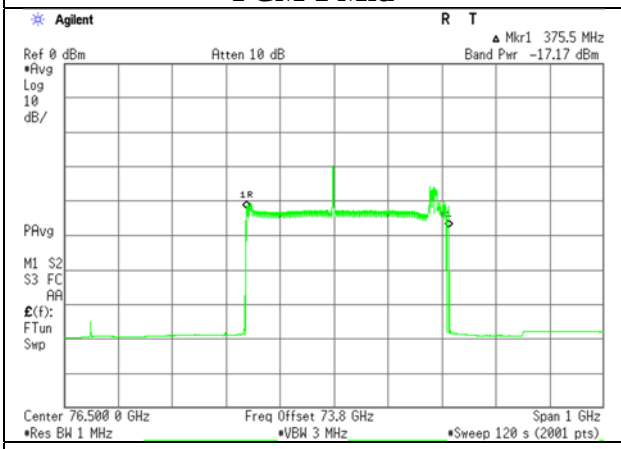
FCM 1 Low



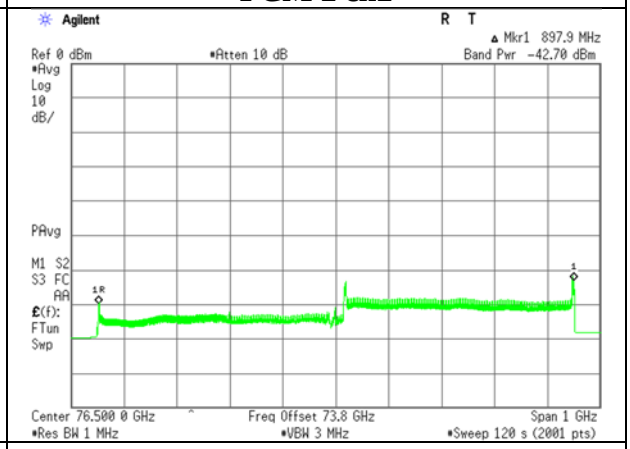
FCM 2 ch1



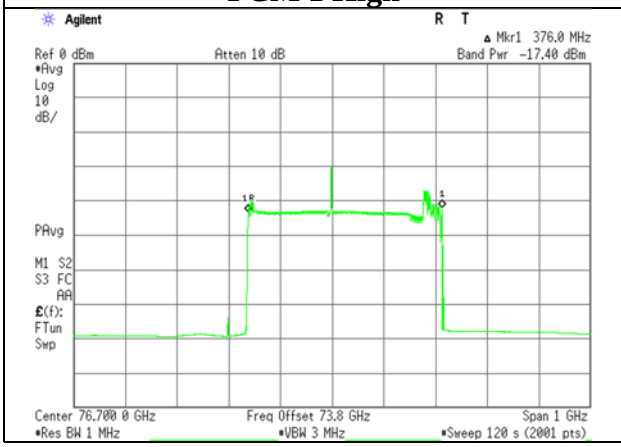
FCM 1 Mid



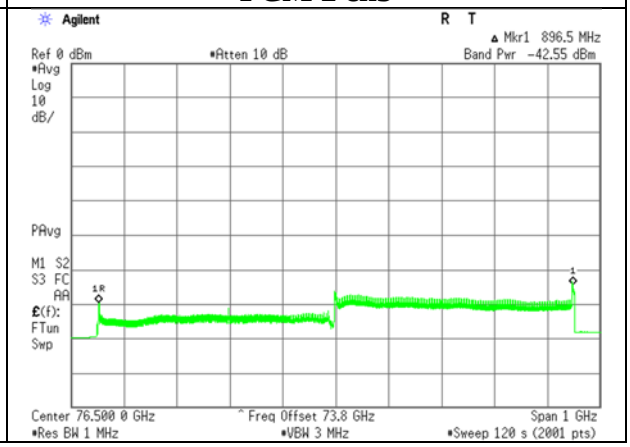
FCM 2 ch2



FCM 1 High



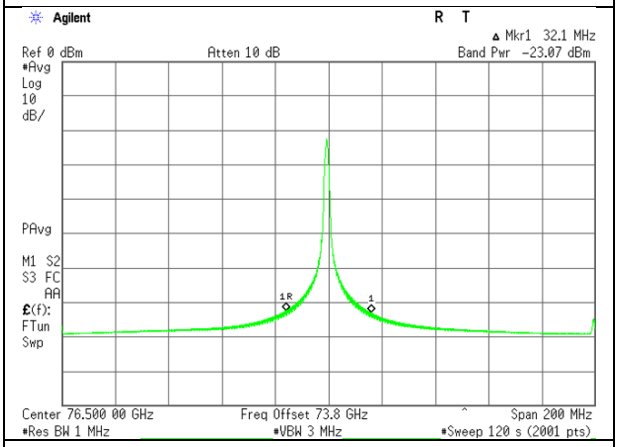
FCM 2 ch3



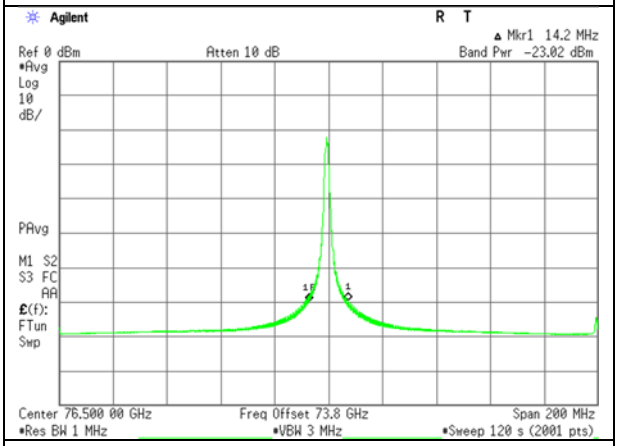
Radiated Power

Average

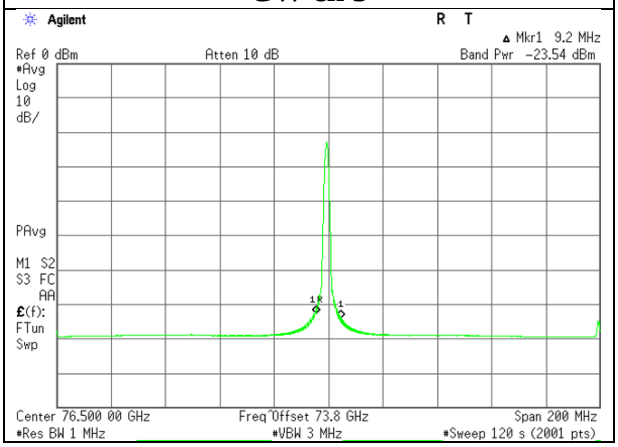
CW ch 1



CW ch 2



CW ch 3



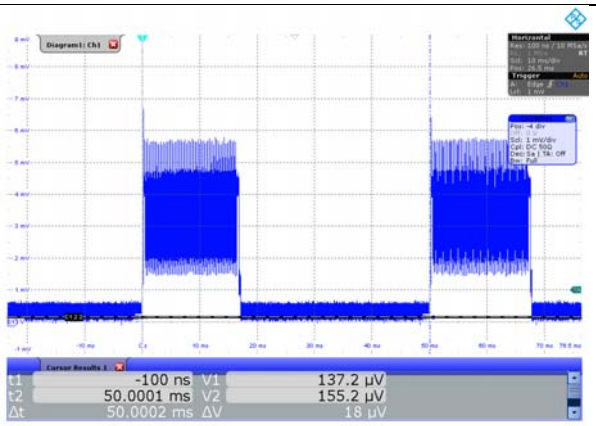
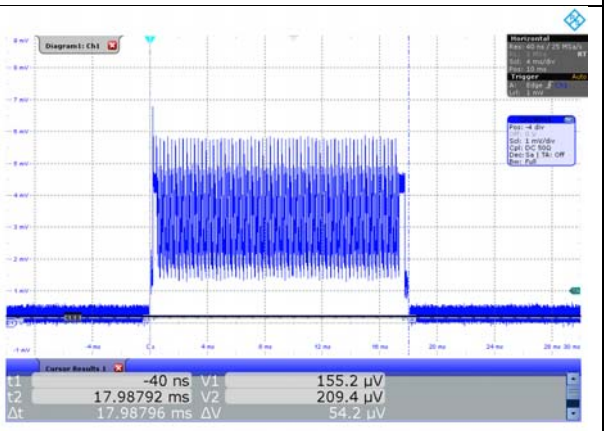
Duty

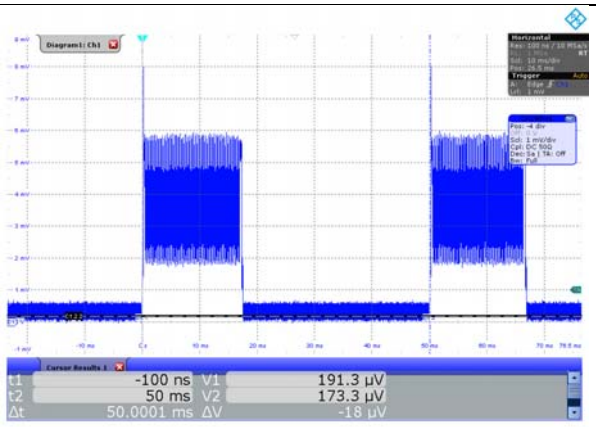
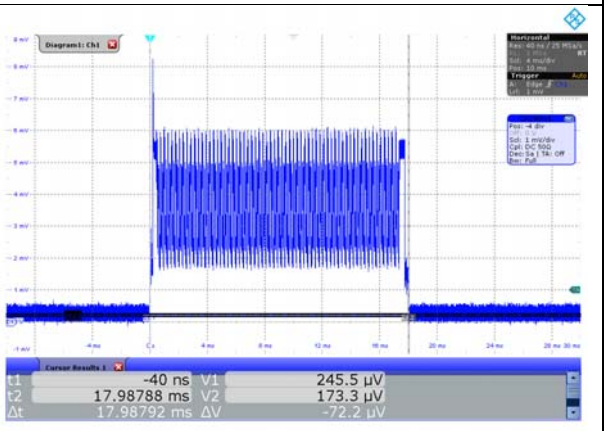
Report No.	13408006H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	July 21, 2020
Temperature / Humidity	22 deg. C / 62 % RH
Engineer	Yuichiro Yamazaki
Mode	Tx

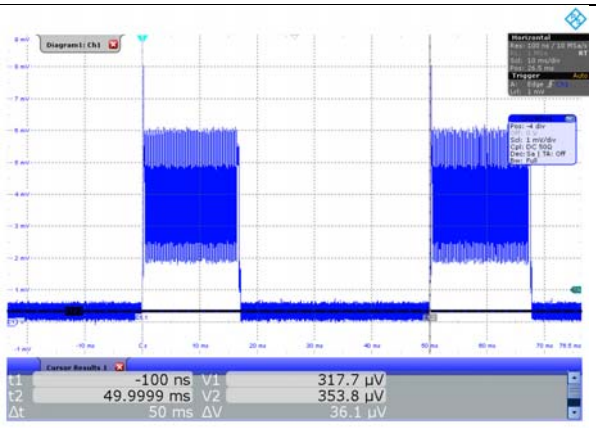
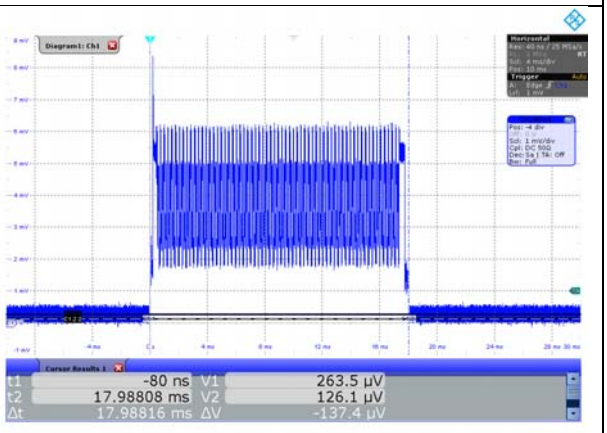
Mode	Tx on time [ms]	Tx on + Tx off time [ms]	Duty Factor [dB]
FCM 1 Low	17.99	50.00	-4.44
FCM 1 Mid	17.99	50.00	-4.44
FCM 1 High	17.99	50.00	-4.44
FCM 2 ch 1	0.135	51.10	-25.77
FCM 2 ch 2	0.135	51.10	-25.77
FCM 2 ch 3	0.135	51.10	-25.77
CW ch 1	15.99	50.00	-4.95
CW ch 2	16.22	50.00	-4.89
CW ch 3	16.45	50.00	-4.83

Calculation: Duty Factor = 10 * log(Tx on time / Tx on + Tx off time)

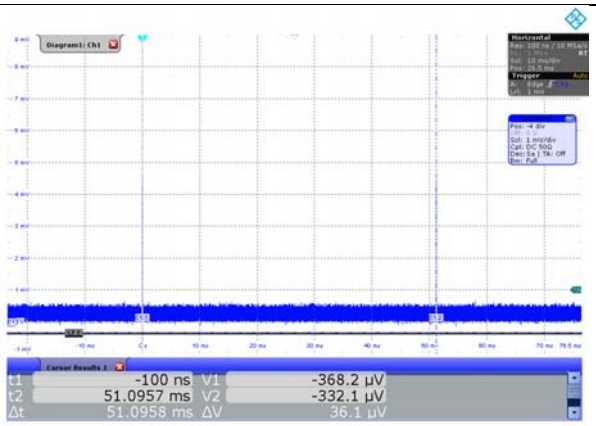
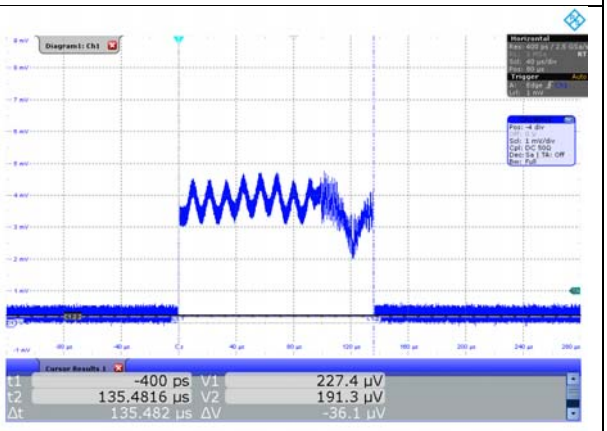
Duty

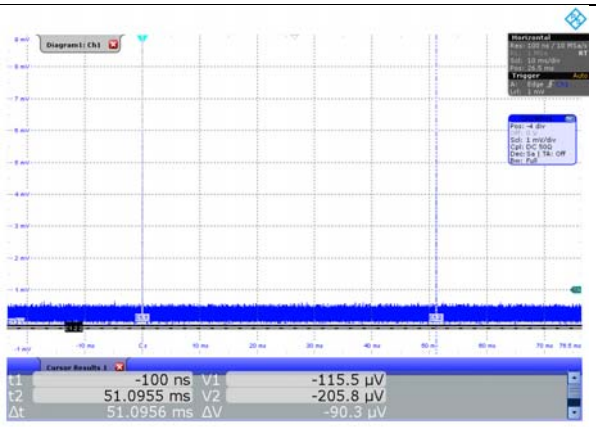
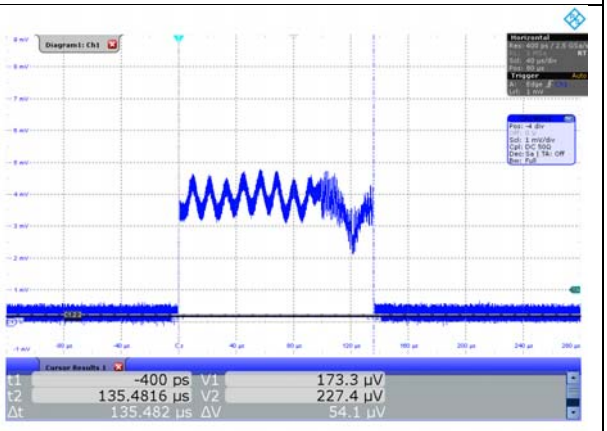
FCM 1 Low	
Tx on + Tx off	Tx on
	

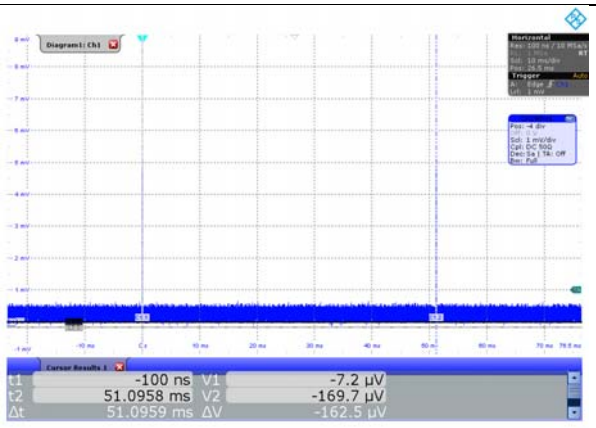
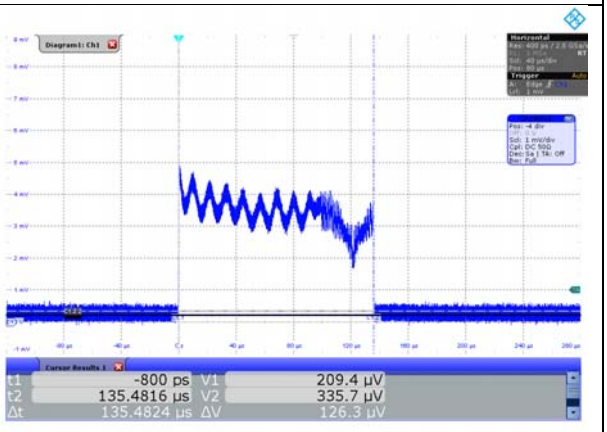
FCM 1 Mid	
Tx on + Tx off	Tx on
	

FCM 1 High	
Tx on + Tx off	Tx on
	

Duty

FCM 2 ch1	
Tx on + Tx off	Tx on
	

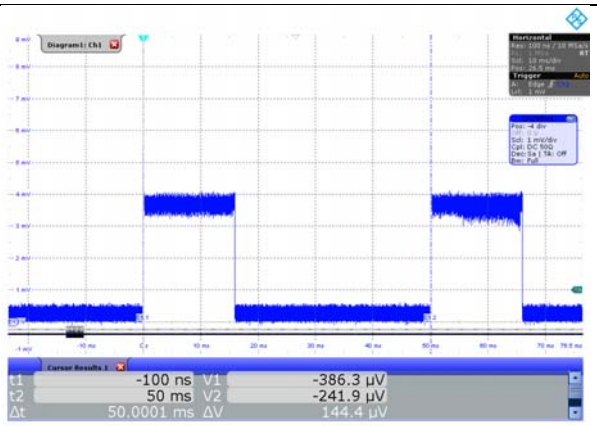
FCM 2 ch2	
Tx on + Tx off	Tx on
	

FCM 2 ch 3	
Tx on + Tx off	Tx on
	

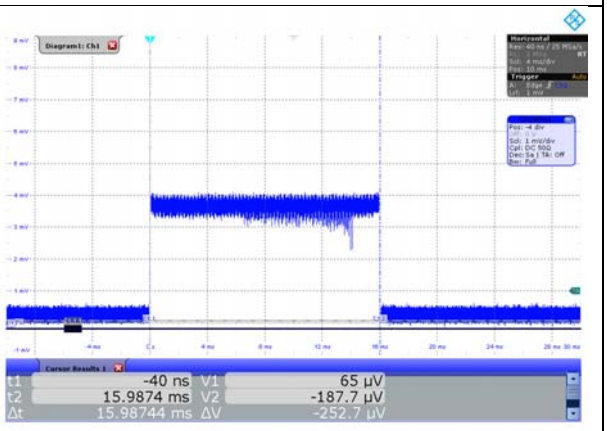
Duty

CW ch 1

Tx on + Tx off

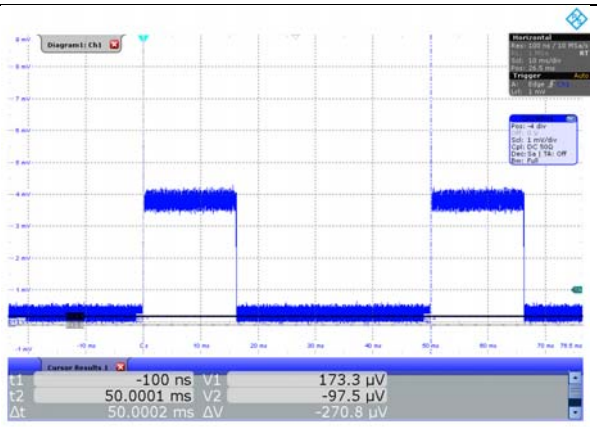


Tx on

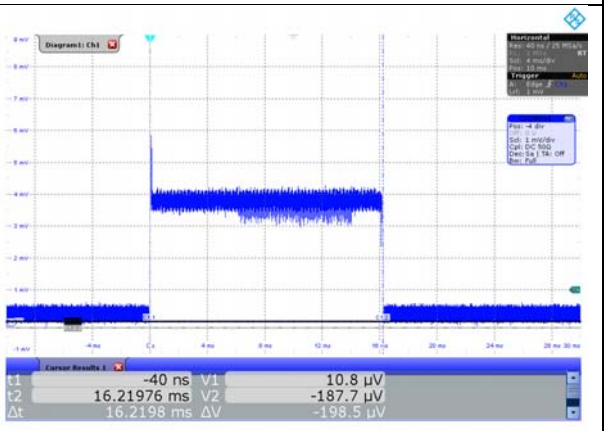


CW ch 2

Tx on + Tx off

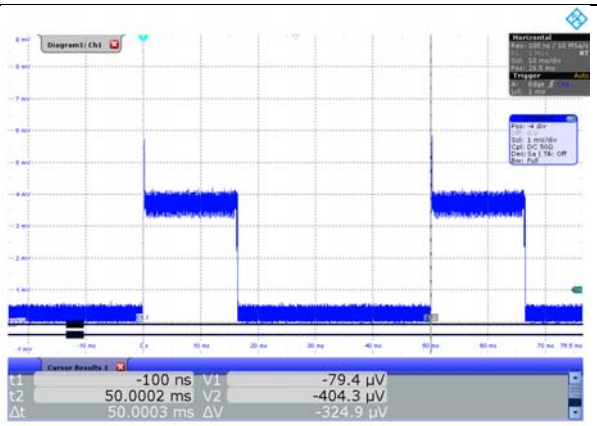


Tx on

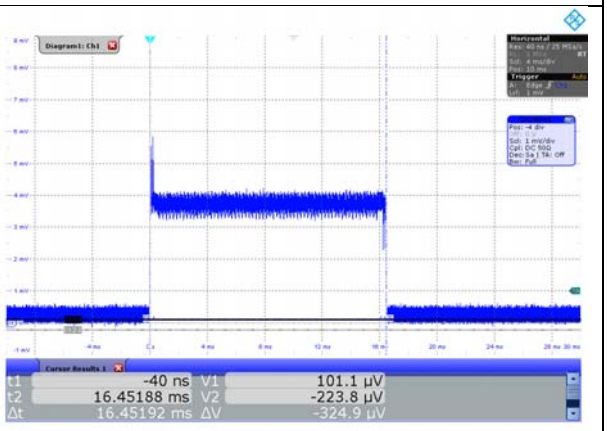


CW ch 3

Tx on + Tx off



Tx on



Modulation characteristics

Report No.	13408006H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	July 21, 2020
Temperature / Humidity	22 deg. C / 62 % RH
Engineer	Yuichiro Yamazaki
Mode	Normal operating mode

[Duty Factor]

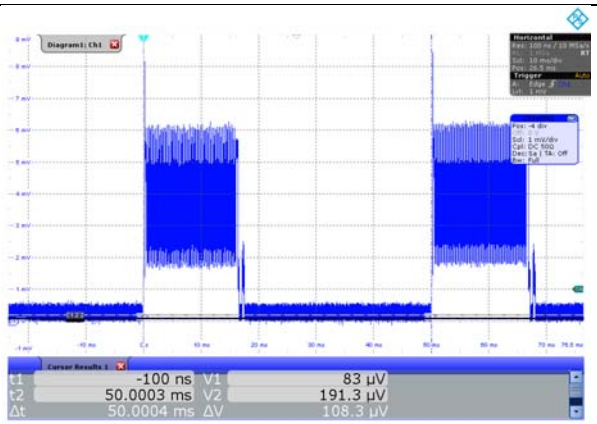
	Tx On time [ms]	Tx On + Off time [ms]	Duty factor [dB]
Measured	18.89	50.00	-4.23
Declared *	18.00	50.00	-4.44

Duty factor = 10 * log (Tx On time / Tx On + Off time)
* See the application document.

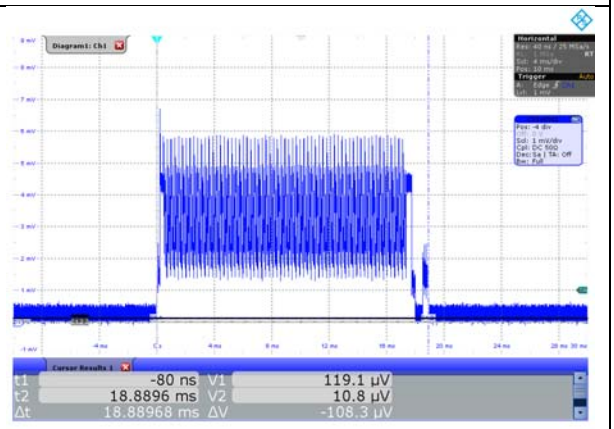
[Data]

(Reference) Normal operating mode

Tx on + Tx off



Tx on



* This Duty Cycle is the worst case. Transmitting time does not exceed it.

Field strength of spurious radiation
(below 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	July 22, 2020	July 23, 2020	July 24, 2020
Temperature / Humidity	20 deg. C / 53 % RH	23 deg. C / 51 % RH	23 deg. C / 67 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	Above 10 GHz	1 GHz - 10 GHz	Below 1 GHz
Mode	Tx FCM 1 Low		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	45.043	QP	22.2	13.0	7.4	32.0	-	10.6	40.0	29.4	
Hori.	80.000	QP	28.3	6.9	7.9	32.0	-	11.1	40.0	28.9	
Hori.	183.629	QP	21.0	16.2	8.9	31.8	-	14.2	43.5	29.3	
Hori.	308.278	QP	21.1	13.7	9.8	31.8	-	12.8	46.0	33.2	
Hori.	572.459	QP	21.2	18.4	11.3	32.0	-	19.0	46.0	27.0	
Hori.	969.651	QP	19.8	22.3	13.2	30.7	-	24.6	54.0	29.5	
Vert.	45.043	QP	25.6	13.0	7.4	32.0	-	14.0	40.0	26.0	
Vert.	80.000	QP	28.1	6.9	7.9	32.0	-	10.9	40.0	29.1	
Vert.	106.478	QP	21.6	11.2	8.1	31.9	-	9.1	43.5	34.5	
Vert.	308.278	QP	21.2	13.7	9.8	31.8	-	12.9	46.0	33.1	
Vert.	572.459	QP	21.1	18.4	11.3	32.0	-	18.9	46.0	27.1	
Vert.	969.651	QP	19.9	22.3	13.2	30.7	-	24.7	54.0	29.4	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.50 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.54 dB
26.5 GHz - 40 GHz 20log (0.5 m / 3.0 m) = -15.56 dB

Field strength of spurious radiation (above 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 4	No. 4	No. 4
Date	July 20, 2020	July 21, 2020	July 23, 2020
Temperature / Humidity	20 deg. C / 60 % RH	22 deg. C / 57 % RH	26 deg. C / 41 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	40 GHz - 50 GHz	50 GHz - 75 GHz	75 GHz- 76 GHz
	83 GHz - 110 GHz	110 GHz - 231 GHz	81 GHz - 83 GHz
Mode	Tx FCM 1 Low		

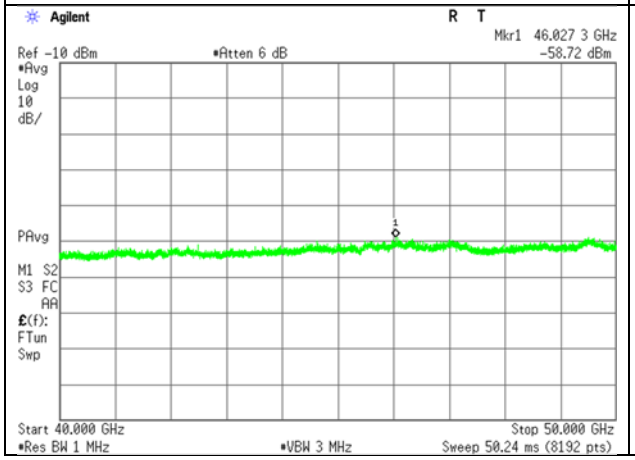
Freq.	Reading	Rx ant. gain	Filter loss	LNA gain	Mixer loss	IF amp. gain	IF cable loss	Meas. range *D*	FSL	EIRP		Power density at 3 m			Remarks
												Result	Limit	Margin	
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[pW/cm^2]	[pW/cm^2]	[dB]	
46.027	-58.72	21.99	0.00	33.08	0.00	0.00	8.47	1.0	65.70	-39.61	0.000109	0.10	600	37.93	
65.059	-76.85	24.09	0.00	23.71	47.85	31.77	0.12	1.0	68.71	-39.74	0.000106	0.09	600	38.06	
75.988	-64.54	23.05	0.00	0.00	-14.52	0.00	1.26	1.0	70.06	-30.79	0.000834	0.74	600	29.11	
82.328	-71.42	23.50	2.16	0.00	-12.03	0.00	2.55	0.5	64.73	-37.51	0.000178	0.16	600	35.82	
83.277	-55.59	23.53	2.51	32.45	0.00	0.00	0.00	1.0	70.85	-38.20	0.000151	0.13	600	36.52	
90.026	-63.74	23.89	0.77	33.43	0.00	0.00	0.00	1.0	71.53	-48.76	0.000013	0.01	600	47.08	
112.908	-90.40	22.39	0.00	18.22	61.22	0.00	0.00	0.01	33.50	-36.29	0.000235	0.21	600	34.61	
131.518	-91.00	22.99	0.00	19.96	52.65	0.00	0.00	0.01	34.82	-46.48	0.000022	0.02	600	44.80	
152.042	-86.38	23.34	0.00	18.26	55.72	0.00	0.00	0.01	36.08	-36.18	0.000241	0.21	600	34.50	
154.506	-92.03	23.36	0.00	17.72	57.26	0.00	0.00	0.01	36.22	-39.63	0.000109	0.10	600	37.94	
170.295	-90.85	22.40	0.00	0.00	60.82	0.00	0.00	0.01	37.07	-15.37	0.029066	25.7	600	13.68	
193.164	-91.03	22.90	0.00	0.00	57.00	0.00	0.00	0.01	38.16	-18.77	0.013284	11.7	600	17.08	
210.560	-92.00	23.17	0.00	0.00	57.13	0.00	0.00	0.01	38.91	-19.13	0.012216	10.8	1000	19.67	
229.110	-87.90	23.34	0.00	0.00	62.18	0.00	0.00	0.01	39.64	-9.42	0.114384	101.1	1000	9.95	

Calculation:

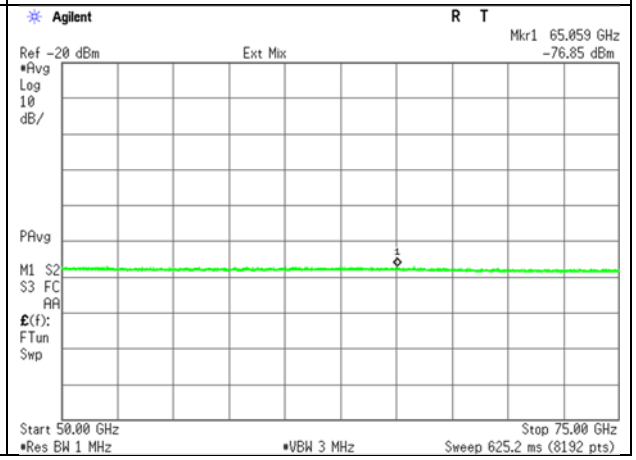
FSL (Free Space path Loss) = 10 * log $((4 * Pi * D / \lambda)^2)$
EIRP = Reading - Rx ant. gain + Filter loss - LNA gain + Mixer loss - IF amp. gain + IF cable loss + FSL
Power density Result at 3 m = EIRP / (4 * Pi * 300^2)

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

40 GHz - 50 GHz

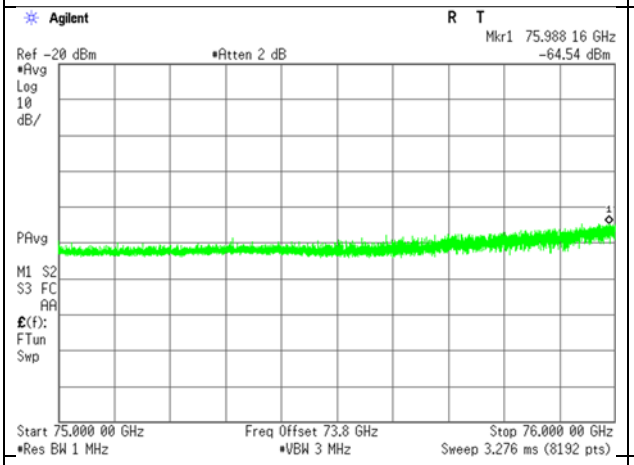


50 GHz - 75 GHz

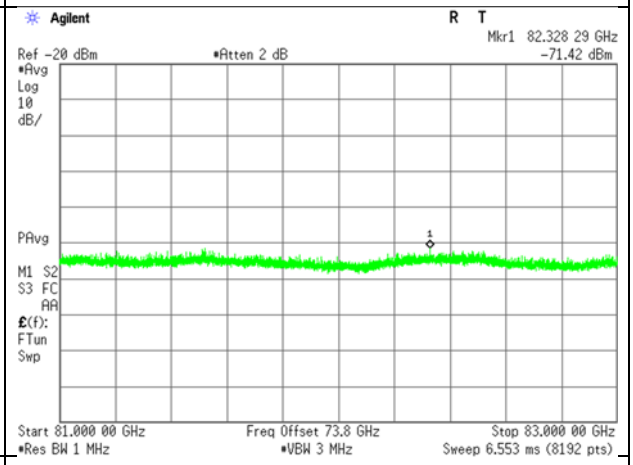


Field strength of spurious radiation
(above 40 GHz)

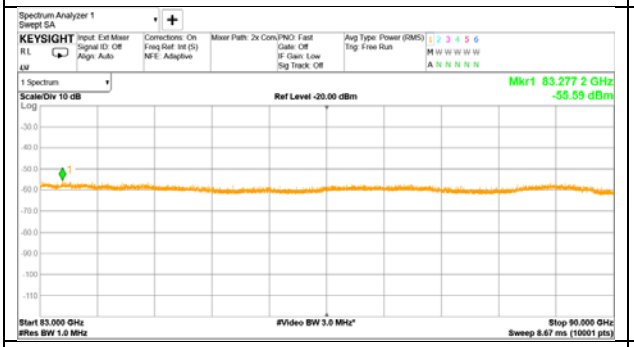
75 GHz - 76 GHz



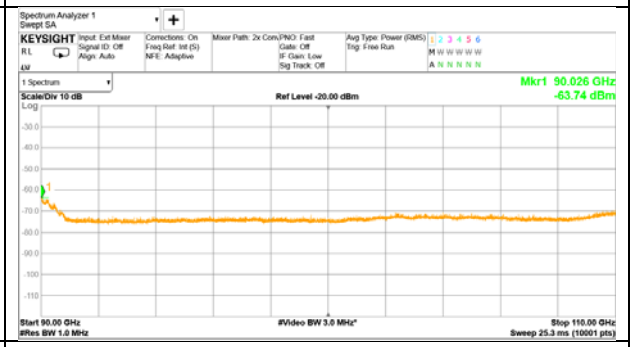
81 GHz - 83 GHz



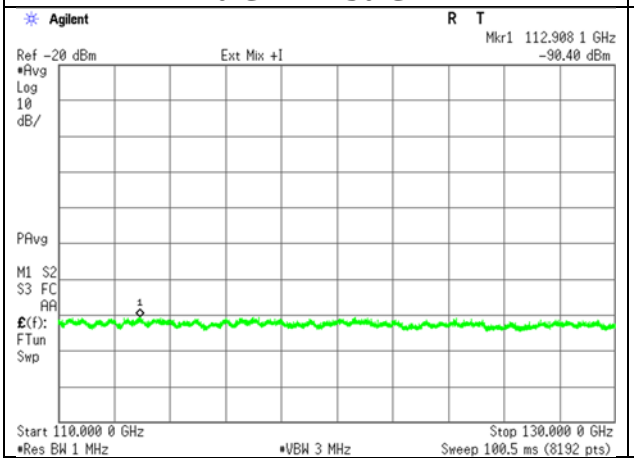
83 GHz - 90 GHz



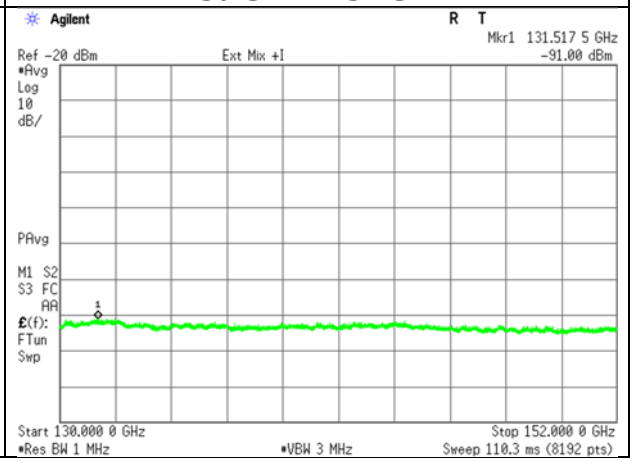
90 GHz - 110 GHz



110 GHz - 130 GHz

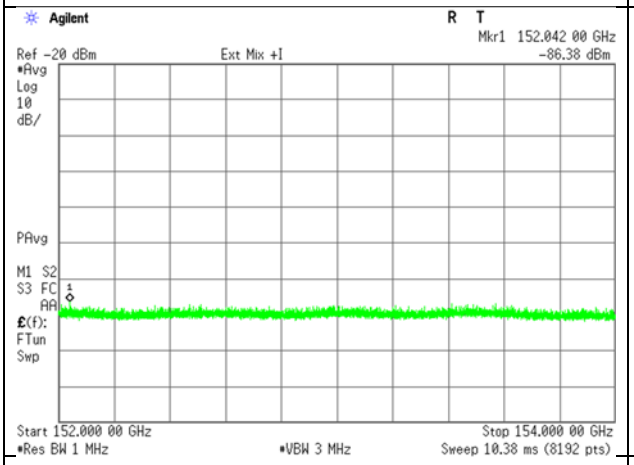


130 GHz - 152 GHz

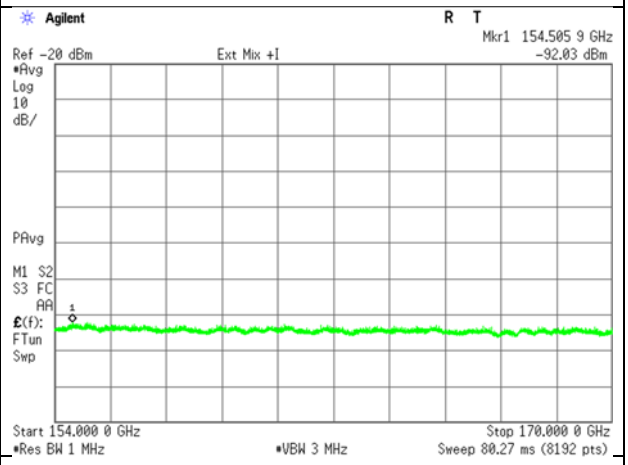


Field strength of spurious radiation
(above 40 GHz)

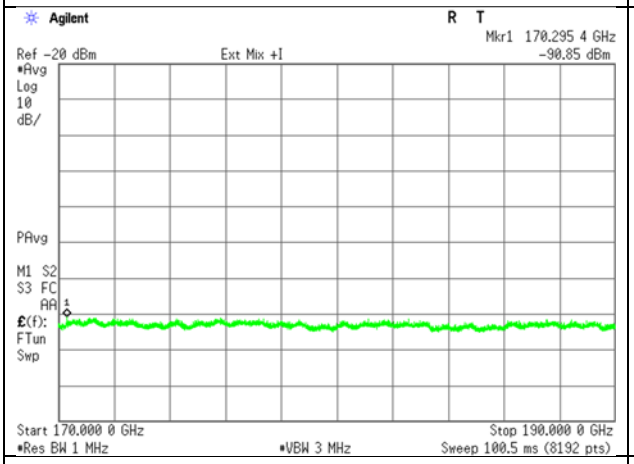
152 GHz - 154 GHz



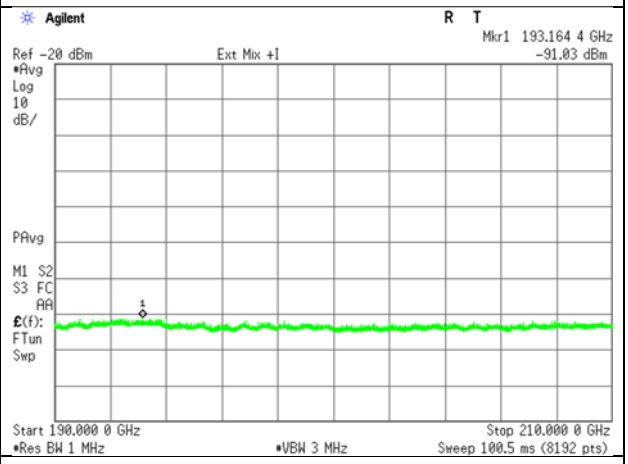
154 GHz - 170 GHz



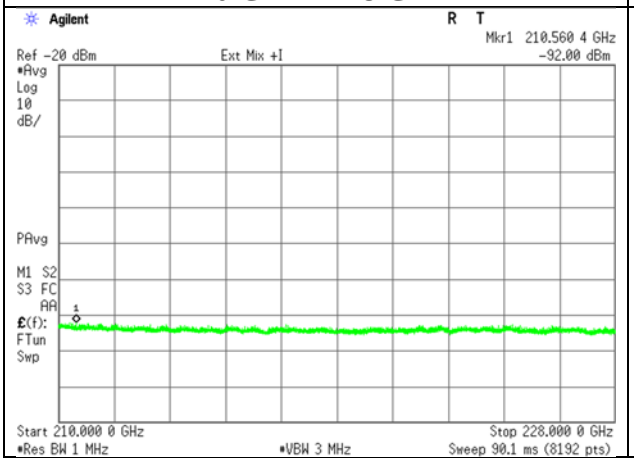
170 GHz - 190 GHz



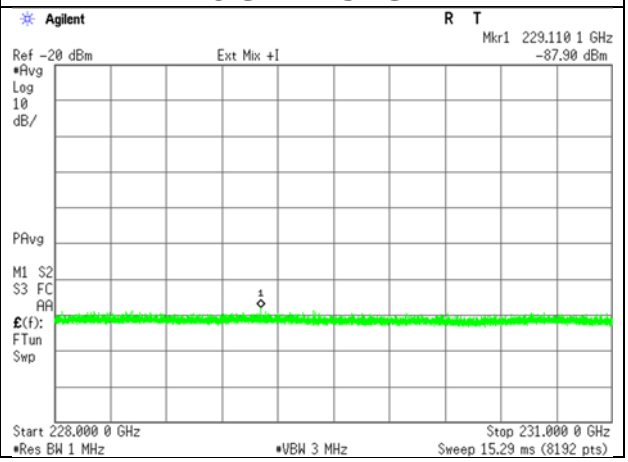
190 GHz - 210 GHz



210 GHz - 228 GHz



228 GHz - 231 GHz



Field strength of spurious radiation
(below 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	July 22, 2020	July 23, 2020	July 24, 2020
Temperature / Humidity	20 deg. C / 53 % RH	23 deg. C / 51 % RH	23 deg. C / 67 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	Above 10 GHz	1 GHz - 10 GHz	Below 1 GHz
Mode	Tx FCM 1 Mid		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	45.032	QP	22.2	13.0	7.4	32.0	-	10.6	40.0	29.4	
Hori.	80.000	QP	28.5	6.9	7.9	32.0	-	11.3	40.0	28.7	
Hori.	183.533	QP	21.0	16.2	8.8	31.8	-	14.2	43.5	29.3	
Hori.	308.895	QP	21.1	13.7	9.8	31.8	-	12.8	46.0	33.2	
Hori.	572.432	QP	21.2	18.4	11.3	32.0	-	19.0	46.0	27.0	
Hori.	969.524	QP	19.9	22.3	13.2	30.7	-	24.7	54.0	29.4	
Vert.	45.032	QP	25.3	13.0	7.4	32.0	-	13.7	40.0	26.3	
Vert.	80.000	QP	28.4	6.9	7.9	32.0	-	11.2	40.0	28.8	
Vert.	183.533	QP	21.1	16.2	8.8	31.8	-	14.3	43.5	29.2	
Vert.	308.895	QP	21.1	13.7	9.8	31.8	-	12.8	46.0	33.2	
Vert.	572.432	QP	21.2	18.4	11.3	32.0	-	19.0	46.0	27.0	
Vert.	969.524	QP	19.8	22.3	13.2	30.7	-	24.6	54.0	29.5	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.50 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.54 dB
26.5 GHz - 40 GHz 20log (0.5 m / 3.0 m) = -15.56 dB

Field strength of spurious radiation (above 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 4	No. 4	No. 4
Date	July 20, 2020	July 21, 2020	July 23, 2020
Temperature / Humidity	20 deg. C / 60 % RH	22 deg. C / 57 % RH	26 deg. C / 41 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	40 GHz - 50 GHz	50 GHz - 75 GHz	75 GHz- 76 GHz
	83 GHz - 110 GHz	110 GHz - 231 GHz	81 GHz - 83 GHz
Mode	Tx FCM 1 Mid		

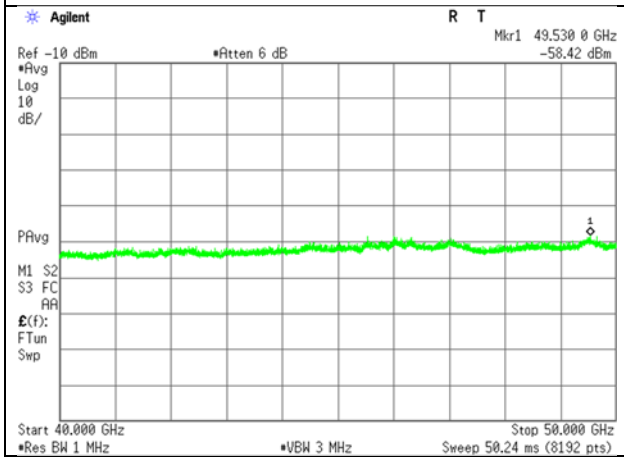
Freq.	Reading	Rx ant. gain	Filter loss	LNA gain	Mixer loss	IF amp. gain	IF cable loss	Meas. range *D*	FSL	EIRP		Power density at 3 m			Remarks
												Result	Limit	Margin	
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[pW/cm^2]	[pW/cm^2]	[dB]	
49.530	-58.42	22.42	0.00	31.73	0.00	0.00	8.97	1.0	66.34	-37.26	0.000188	0.17	600	35.58	
54.542	-76.99	23.27	0.00	27.17	46.24	31.77	0.12	1.0	67.18	-45.67	0.000027	0.02	600	43.98	
76.000	-67.68	23.05	0.00	0.00	-14.50	0.00	1.26	1.0	70.06	-33.91	0.000406	0.36	600	32.23	
81.304	-72.00	23.42	2.41	0.00	-12.32	0.00	2.38	0.5	64.62	-38.33	0.000147	0.13	600	36.64	
83.045	-55.69	23.51	2.04	32.61	0.00	0.00	0.00	1.0	70.83	-38.95	0.000127	0.11	600	37.26	
90.018	-63.26	23.89	0.77	33.43	0.00	0.00	0.00	1.0	71.53	-48.28	0.000015	0.01	600	46.60	
118.951	-90.58	22.61	0.00	19.50	54.47	0.00	0.00	0.01	33.95	-44.27	0.000037	0.03	600	42.59	
130.317	-90.94	22.96	0.00	20.50	52.34	0.00	0.00	0.01	34.74	-47.32	0.000019	0.02	600	45.63	
153.216	-86.76	23.35	0.00	18.06	56.97	0.00	0.00	0.01	36.15	-35.05	0.000313	0.28	600	33.37	
154.524	-91.85	23.36	0.00	17.73	57.23	0.00	0.00	0.01	36.22	-39.48	0.000113	0.10	600	37.80	
172.622	-90.80	22.46	0.00	0.00	57.48	0.00	0.00	0.01	37.18	-18.60	0.013803	12.2	600	16.92	
191.968	-91.16	22.88	0.00	0.00	56.13	0.00	0.00	0.01	38.11	-19.80	0.010460	9.2	600	18.12	
211.105	-92.01	23.18	0.00	0.00	57.29	0.00	0.00	0.01	38.93	-18.97	0.012685	11.2	1000	19.50	
230.763	-88.44	23.35	0.00	0.00	64.17	0.00	0.00	0.01	39.71	-7.91	0.161625	142.9	1000	8.45	

Calculation:

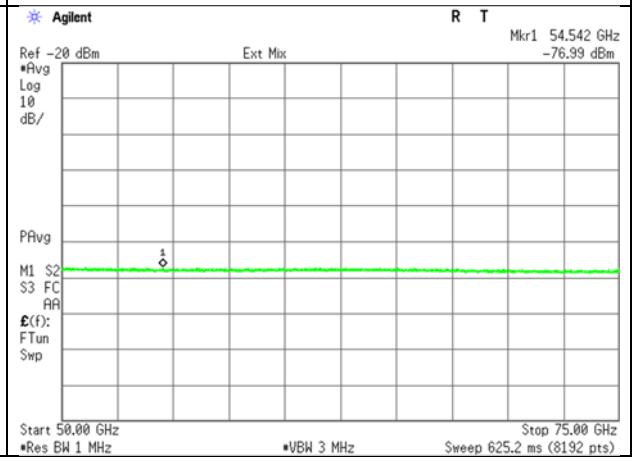
FSL (Free Space path Loss) = 10 * log (($4 * \pi * D / \lambda$)^2)
EIRP = Reading - Rx ant. gain + Filter loss - LNA gain + Mixer loss - IF amp. gain + IF cable loss + FSL
Power density Result at 3 m = EIRP / ($4 * \pi * 300^2$)

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

40 GHz - 50 GHz

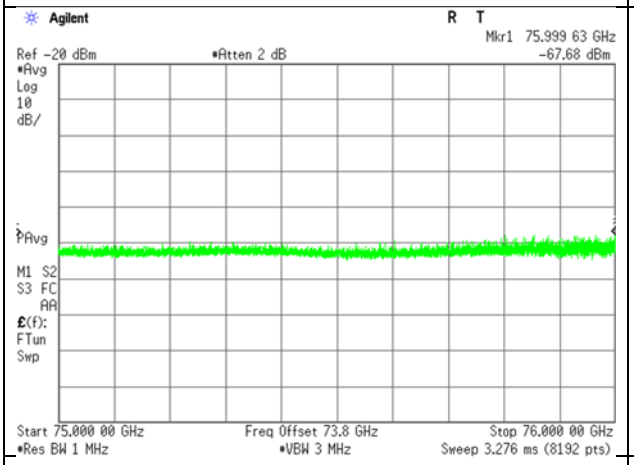


50 GHz - 75 GHz

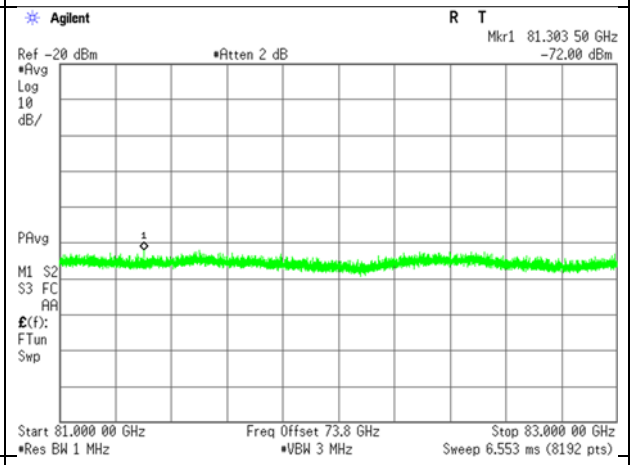


Field strength of spurious radiation
(above 40 GHz)

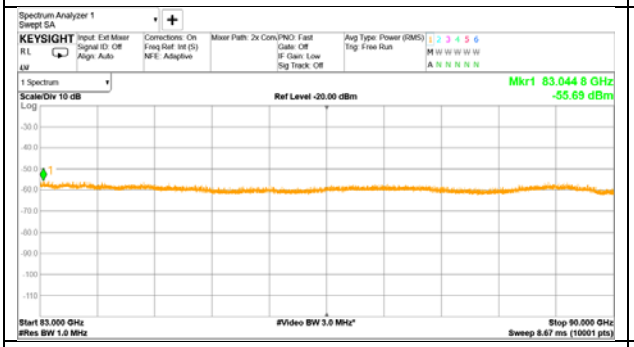
75 GHz - 76 GHz



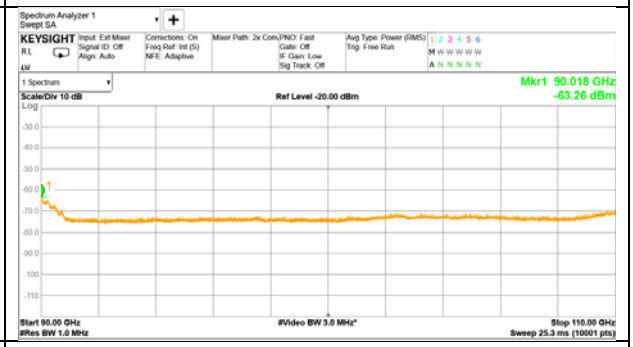
81 GHz - 83 GHz



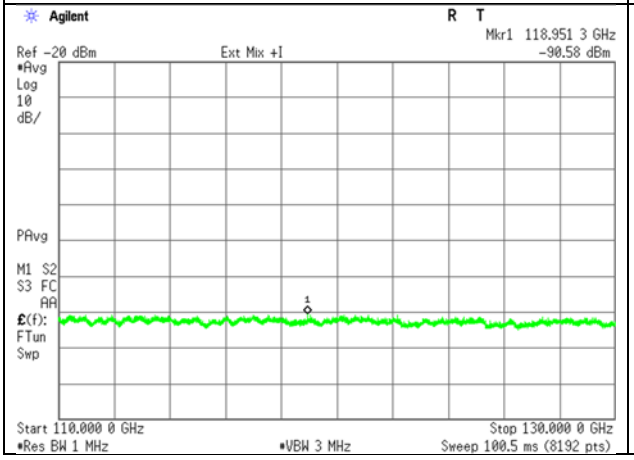
83 GHz - 90 GHz



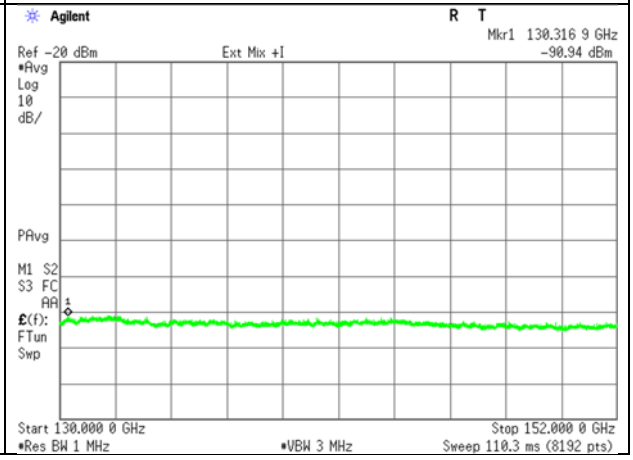
90 GHz - 110 GHz



110 GHz - 130 GHz

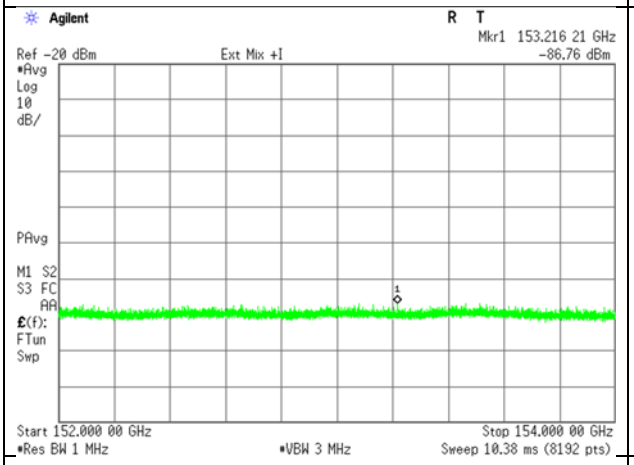


130 GHz - 152 GHz

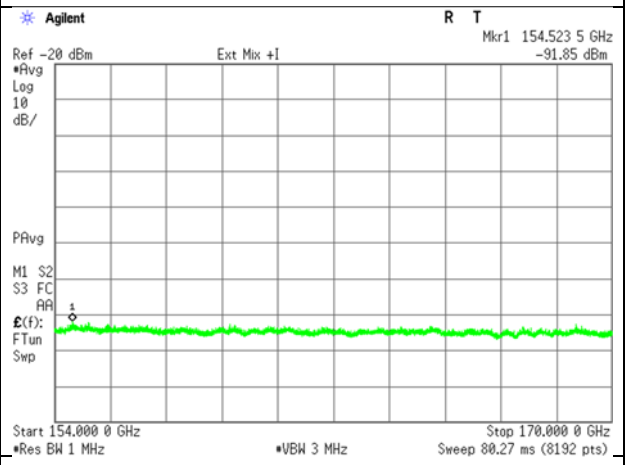


Field strength of spurious radiation
(above 40 GHz)

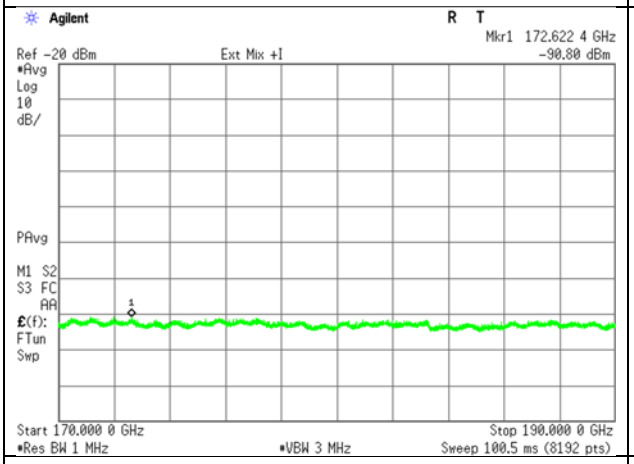
152 GHz - 154 GHz



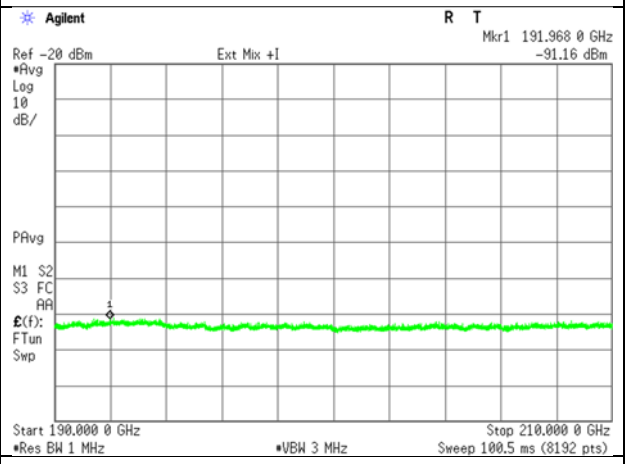
154 GHz - 170 GHz



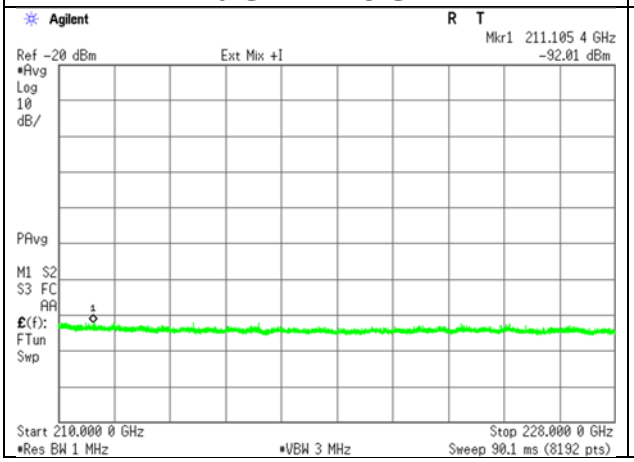
170 GHz - 190 GHz



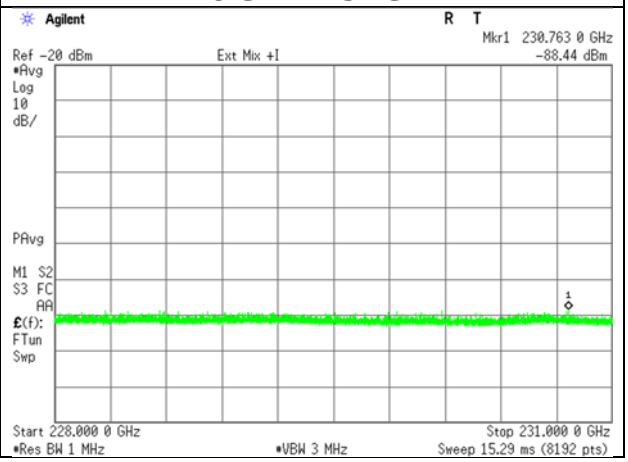
190 GHz - 210 GHz



210 GHz - 228 GHz



228 GHz - 231 GHz



Field strength of spurious radiation
(below 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	July 22, 2020	July 23, 2020	July 24, 2020
Temperature / Humidity	20 deg. C / 53 % RH	23 deg. C / 51 % RH	23 deg. C / 67 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	Above 10 GHz	1 GHz - 10 GHz	Below 1 GHz
Mode	Tx FCM 1 High		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	45.072	QP	22.2	13.0	7.4	32.0	-	10.6	40.0	29.4	
Hori.	80.000	QP	28.2	6.9	7.9	32.0	-	11.0	40.0	29.0	
Hori.	183.542	QP	21.0	16.2	8.9	31.8	-	14.2	43.5	29.3	
Hori.	308.766	QP	21.1	13.7	9.8	31.8	-	12.8	46.0	33.2	
Hori.	572.839	QP	21.2	18.4	11.3	32.0	-	19.0	46.0	27.0	
Hori.	969.435	QP	19.9	22.3	13.2	30.7	-	24.7	54.0	29.4	
Vert.	45.072	QP	25.9	13.0	7.4	32.0	-	14.3	40.0	25.7	
Vert.	80.000	QP	27.7	6.9	7.9	32.0	-	10.5	40.0	29.5	
Vert.	183.542	QP	20.9	16.2	8.9	31.8	-	14.1	43.5	29.4	
Vert.	308.766	QP	21.1	13.7	9.8	31.8	-	12.8	46.0	33.2	
Vert.	572.839	QP	21.2	18.4	11.3	32.0	-	19.0	46.0	27.0	
Vert.	969.435	QP	19.9	22.3	13.2	30.7	-	24.7	54.0	29.4	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.50 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.54 dB
26.5 GHz - 40 GHz 20log (0.5 m / 3.0 m) = -15.56 dB

Field strength of spurious radiation (above 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 4	No. 4	No. 4
Date	July 20, 2020	July 21, 2020	July 23, 2020
Temperature / Humidity	20 deg. C / 60 % RH	22 deg. C / 57 % RH	26 deg. C / 41 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	40 GHz - 50 GHz	50 GHz - 75 GHz	75 GHz- 76 GHz
	83 GHz - 110 GHz	110 GHz - 231 GHz	81 GHz - 83 GHz
Mode	Tx FCM 1 High		

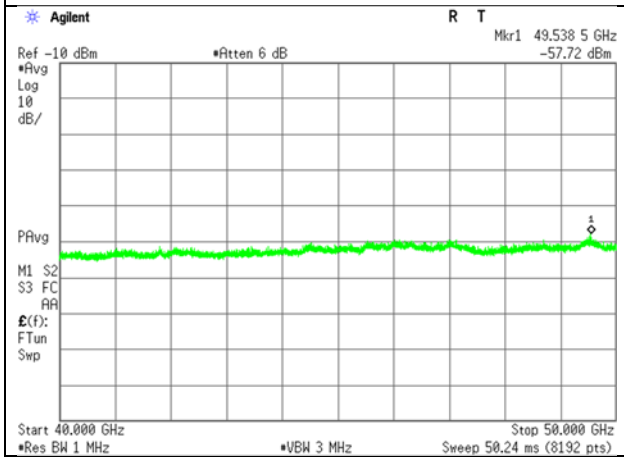
Freq.	Reading	Rx ant. gain	Filter loss	LNA gain	Mixer loss	IF amp. gain	IF cable loss	Meas. range D	FSL	EIRP		Power density at 3 m			Remarks
												Result	Limit	Margin	
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[pW/cm^2]	[pW/cm^2]	[dB]	
49.539	-57.72	22.43	0.00	31.72	0.00	0.00	8.97	1.0	66.34	-36.55	0.000221	0.20	600	34.87	
50.378	-76.98	22.86	0.00	26.36	47.85	31.77	0.12	1.0	66.49	-43.51	0.000045	0.04	600	41.83	
75.817	-68.33	23.03	0.00	0.00	-14.86	0.00	1.20	1.0	70.04	-34.99	0.000317	0.28	600	33.30	
82.296	-72.03	23.50	2.17	0.00	-11.95	0.00	2.55	0.5	64.73	-38.03	0.000158	0.14	600	36.34	
83.568	-55.47	23.55	2.52	32.24	0.00	0.00	0.00	1.0	70.88	-37.86	0.000164	0.14	600	36.17	
90.000	-63.23	23.89	0.77	33.43	0.00	0.00	0.00	1.0	71.53	-48.25	0.000015	0.01	600	46.57	
114.959	-90.42	22.46	0.00	18.36	57.72	0.00	0.00	0.01	33.65	-39.87	0.000103	0.09	600	38.19	
132.399	-91.10	23.01	0.00	19.74	53.24	0.00	0.00	0.01	34.88	-45.73	0.000027	0.02	600	44.05	
152.963	-86.51	23.35	0.00	18.21	56.63	0.00	0.00	0.01	36.13	-35.30	0.000295	0.26	600	33.62	
154.549	-91.81	23.36	0.00	17.74	57.19	0.00	0.00	0.01	36.22	-39.49	0.000112	0.10	600	37.81	
187.827	-90.86	22.80	0.00	0.00	57.69	0.00	0.00	0.01	37.92	-18.06	0.015646	13.8	600	16.37	
192.386	-91.38	22.89	0.00	0.00	56.53	0.00	0.00	0.01	38.13	-19.61	0.010928	9.7	600	17.93	
210.255	-91.95	23.17	0.00	0.00	56.98	0.00	0.00	0.01	38.90	-19.24	0.011914	10.5	1000	19.77	
230.462	-88.65	23.35	0.00	0.00	63.82	0.00	0.00	0.01	39.69	-8.49	0.141669	125.3	1000	9.02	

Calculation:

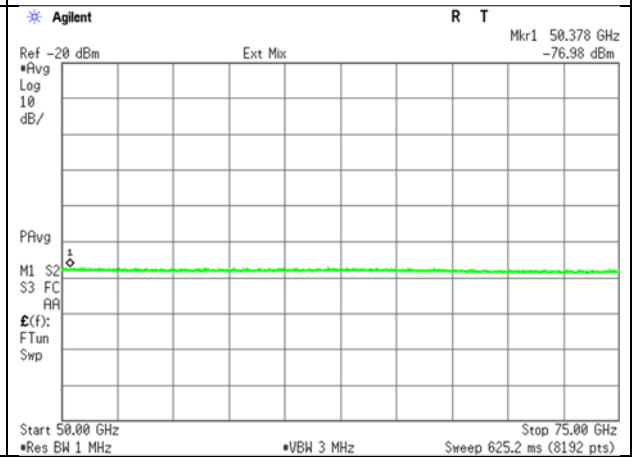
FSL (Free Space path Loss) = 10 * log $((4 * Pi * D / \lambda)^2)$
EIRP = Reading - Rx ant. gain + Filter loss - LNA gain + Mixer loss - IF amp. gain + IF cable loss + FSL
Power density Result at 3 m = EIRP / $(4 * Pi * 300^2)$

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

40 GHz - 50 GHz

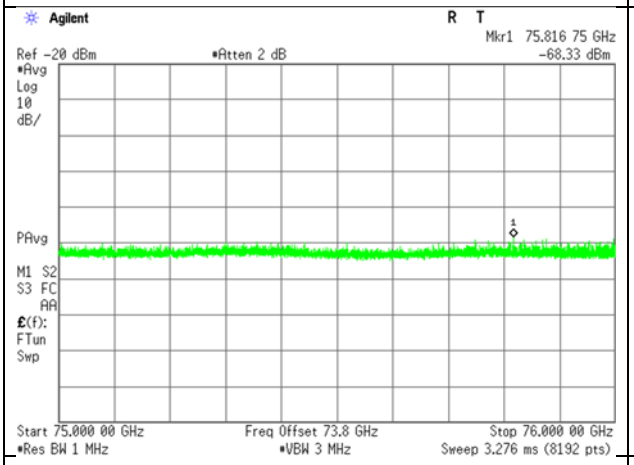


50 GHz - 75 GHz

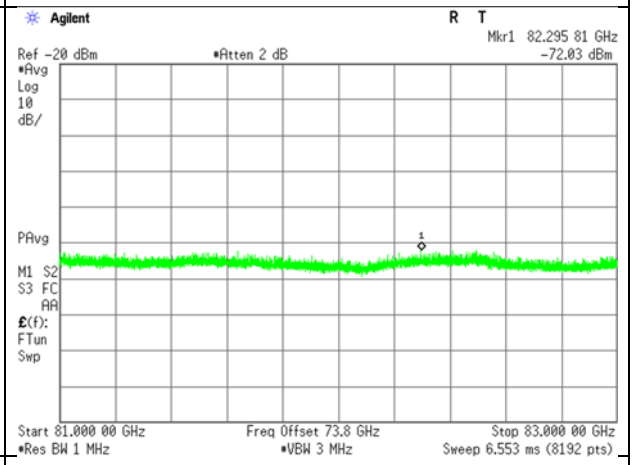


Field strength of spurious radiation
(above 40 GHz)

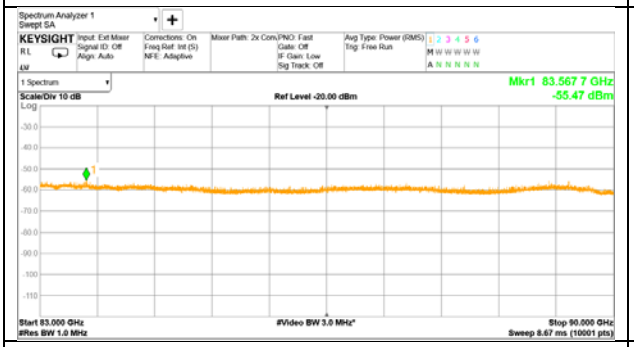
75 GHz - 76 GHz



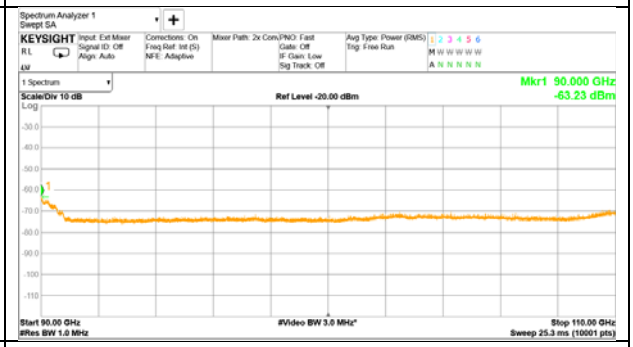
81 GHz - 83 GHz



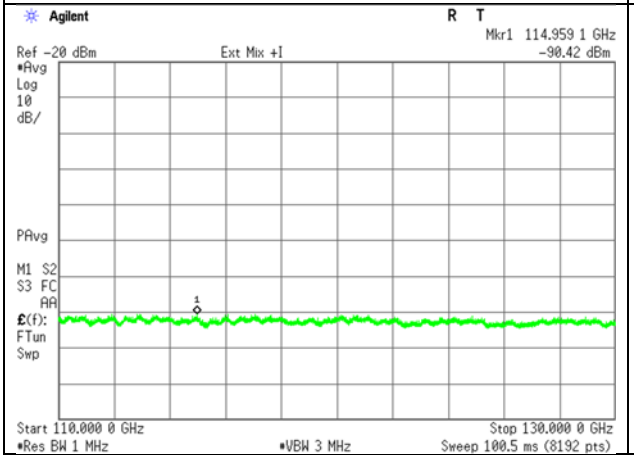
83 GHz - 90 GHz



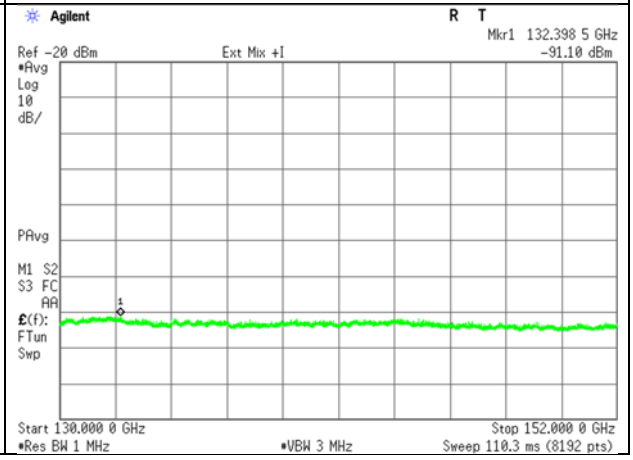
90 GHz - 110 GHz



110 GHz - 130 GHz



130 GHz - 152 GHz



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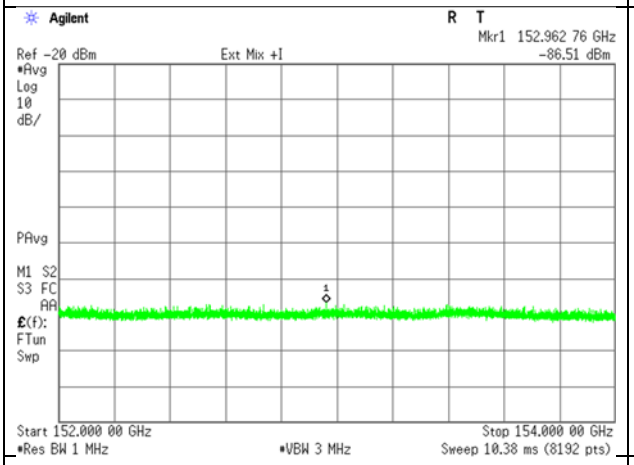
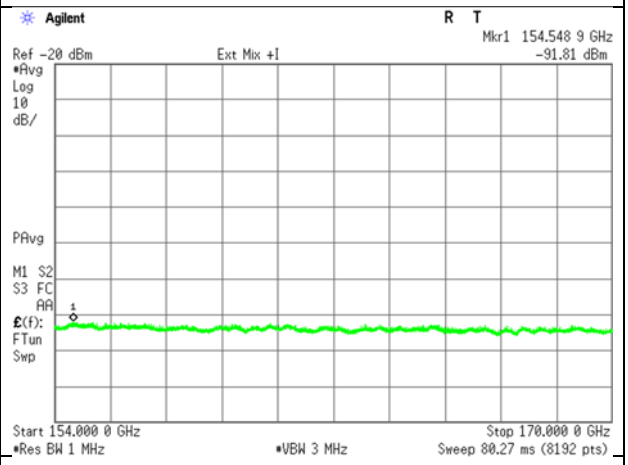
Field strength of spurious radiation
(above 40 GHz)

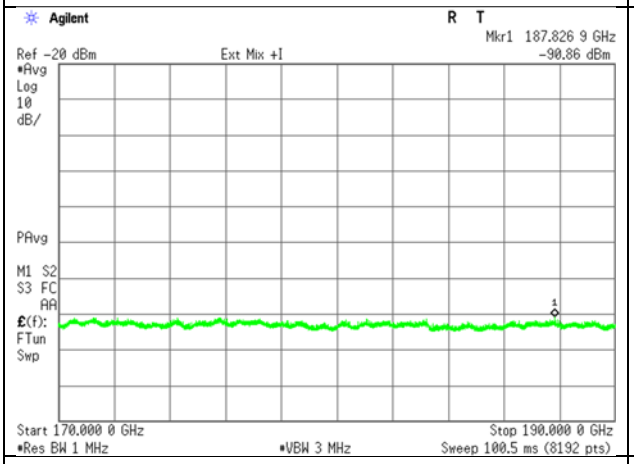
152 GHz - 154 GHz



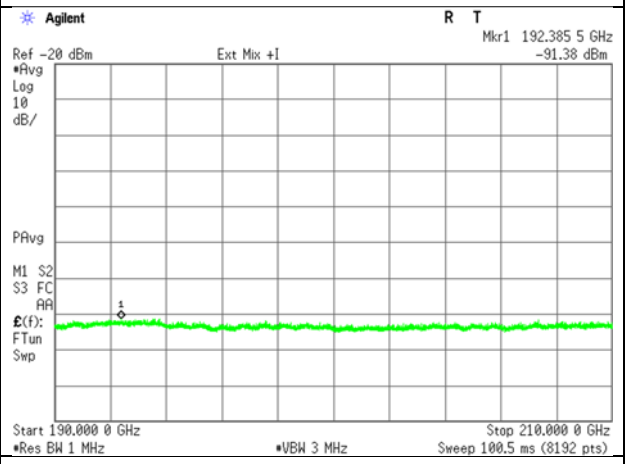
154 GHz - 170 GHz



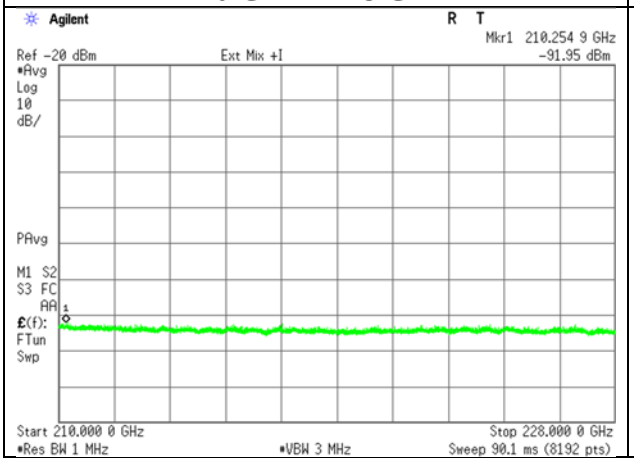
170 GHz - 190 GHz



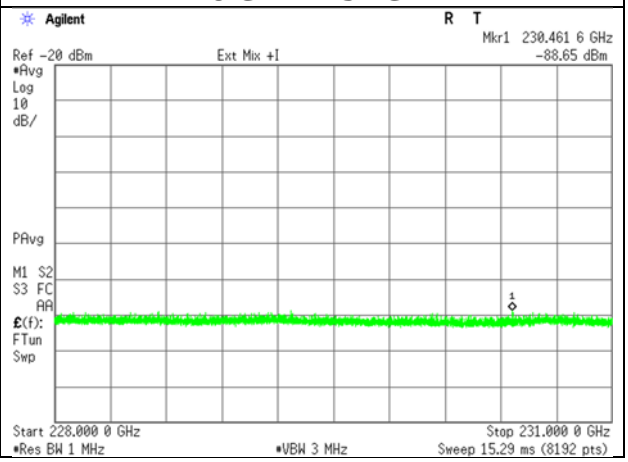
190 GHz - 210 GHz



210 GHz - 228 GHz



228 GHz - 231 GHz



Field strength of spurious radiation
(below 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	July 22, 2020	July 23, 2020	July 24, 2020
Temperature / Humidity	20 deg. C / 53 % RH	23 deg. C / 51 % RH	23 deg. C / 67 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	Above 10 GHz	1 GHz - 10 GHz	Below 1 GHz
Mode	Tx FCM 2 ch 3		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	45.167	QP	22.2	12.9	7.4	32.0	-	10.6	40.0	29.4	
Hori.	80.000	QP	28.3	6.9	7.9	32.0	-	11.1	40.0	28.9	
Hori.	183.954	QP	21.1	16.2	8.9	31.8	-	14.3	43.5	29.2	
Hori.	308.685	QP	21.1	13.7	9.8	31.8	-	12.8	46.0	33.2	
Hori.	572.804	QP	21.2	18.4	11.3	32.0	-	19.0	46.0	27.0	
Hori.	969.697	QP	19.9	22.3	13.2	30.7	-	24.7	54.0	29.4	
Vert.	45.167	QP	25.9	12.9	7.4	32.0	-	14.3	40.0	25.7	
Vert.	80.000	QP	28.9	6.9	7.9	32.0	-	11.7	40.0	28.3	
Vert.	183.954	QP	21.1	16.2	8.9	31.8	-	14.3	43.5	29.2	
Vert.	308.685	QP	21.1	13.7	9.8	31.8	-	12.8	46.0	33.2	
Vert.	572.804	QP	21.2	18.4	11.3	32.0	-	19.0	46.0	27.0	
Vert.	969.697	QP	19.9	22.3	13.2	30.7	-	24.7	54.0	29.4	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.50 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.54 dB
26.5 GHz - 40 GHz 20log (0.5 m / 3.0 m) = -15.56 dB

Field strength of spurious radiation (above 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 4	No. 4	No. 4
Date	July 20, 2020	July 21, 2020	July 23, 2020
Temperature / Humidity	20 deg. C / 60 % RH	22 deg. C / 57 % RH	26 deg. C / 41 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	40 GHz - 50 GHz	50 GHz - 75 GHz	75 GHz- 76 GHz
	83 GHz - 110 GHz	110 GHz - 231 GHz	81 GHz - 83 GHz
Mode	Tx FCM 2 ch 3		

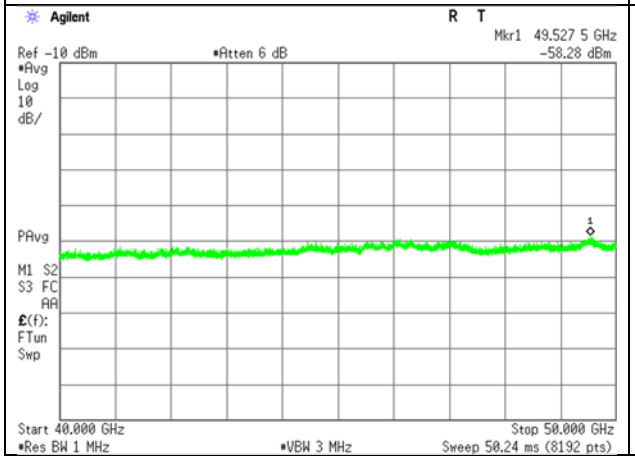
Freq.	Reading	Rx ant. gain	Filter loss	LNA gain	Mixer loss	IF amp. gain	IF cable loss	Meas. range *D*	FSL	EIRP		Power density at 3 m			Remarks
												Result	Limit	Margin	
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[pW/cm^2]	[pW/cm^2]	[dB]	
49.528	-58.28	22.42	0.00	31.73	0.00	0.00	8.97	1.0	66.34	-37.12	0.000194	0.17	600	35.44	
50.586	-76.92	22.84	0.00	26.23	47.60	31.77	0.12	1.0	66.52	-43.52	0.000044	0.04	600	41.84	
75.840	-69.95	23.03	0.00	0.00	-14.81	0.00	1.21	1.0	70.04	-36.54	0.000222	0.20	600	34.86	
82.370	-71.37	23.50	2.16	0.00	-12.13	0.00	2.56	0.5	64.74	-37.54	0.000176	0.16	600	35.86	
83.239	-56.26	23.53	2.42	32.47	0.00	0.00	0.00	1.0	70.85	-38.99	0.000126	0.11	600	37.31	
90.008	-62.66	23.89	0.77	33.43	0.00	0.00	0.00	1.0	71.53	-47.68	0.000017	0.02	600	46.00	
116.998	-90.56	22.53	0.00	18.32	56.64	0.00	0.00	0.01	33.81	-40.97	0.000080	0.07	600	39.28	
132.296	-91.04	23.01	0.00	19.73	52.98	0.00	0.00	0.01	34.87	-45.93	0.000026	0.02	600	44.25	
153.516	-86.61	23.36	0.00	17.87	57.38	0.00	0.00	0.01	36.16	-34.30	0.000372	0.33	600	32.61	
154.920	-91.91	23.37	0.00	17.87	56.60	0.00	0.00	0.01	36.24	-40.31	0.000093	0.08	600	38.62	
175.782	-90.72	22.53	0.00	0.00	58.36	0.00	0.00	0.01	37.34	-17.55	0.017572	15.5	600	15.87	
193.218	-91.26	22.90	0.00	0.00	56.93	0.00	0.00	0.01	38.16	-19.07	0.012396	11.0	600	17.38	
210.411	-91.57	23.17	0.00	0.00	57.06	0.00	0.00	0.01	38.90	-18.77	0.013259	11.7	1000	19.31	
229.072	-88.77	23.34	0.00	0.00	62.13	0.00	0.00	0.01	39.64	-10.34	0.092474	81.8	1000	10.87	

Calculation:

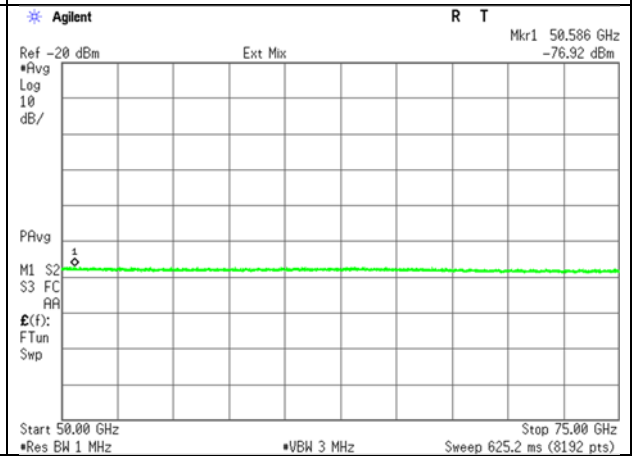
FSL (Free Space path Loss) = 10 * log ((4 * Pi * D / λ) ^{2})
EIRP = Reading - Rx ant. gain + Filter loss - LNA gain + Mixer loss - IF amp. gain + IF cable loss + FSL
Power density Result at 3 m = EIRP / (4 * Pi * 300 ^{2})

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

40 GHz - 50 GHz

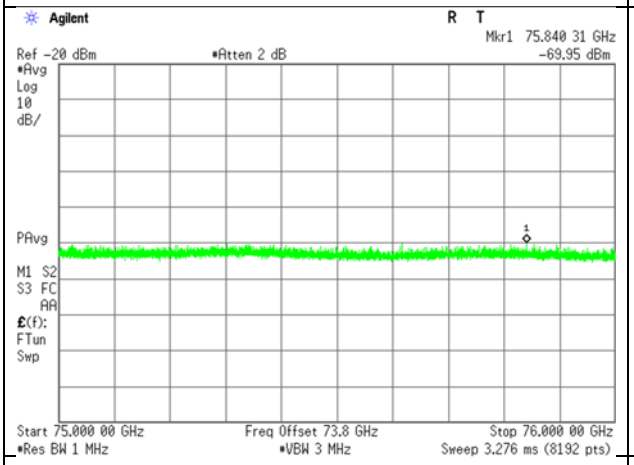


50 GHz - 75 GHz

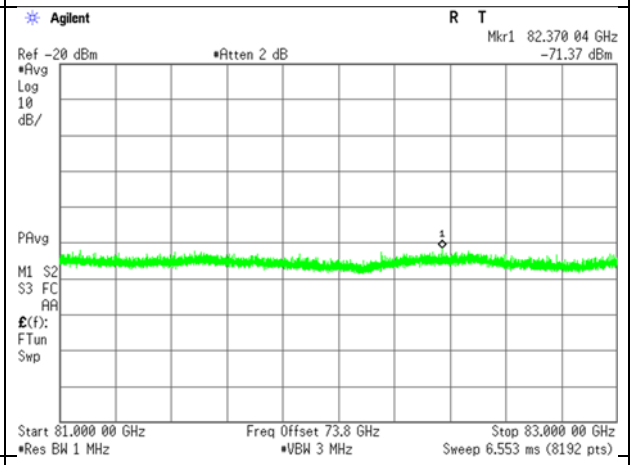


Field strength of spurious radiation
(above 40 GHz)

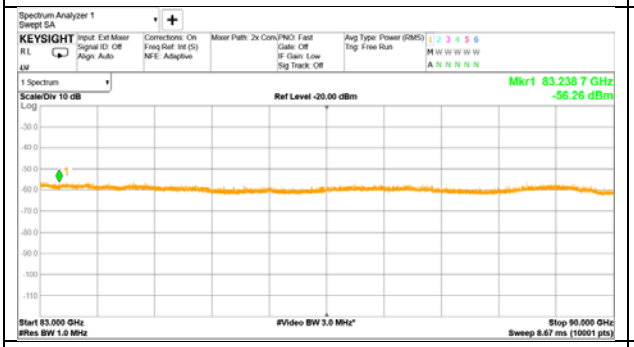
75 GHz - 76 GHz



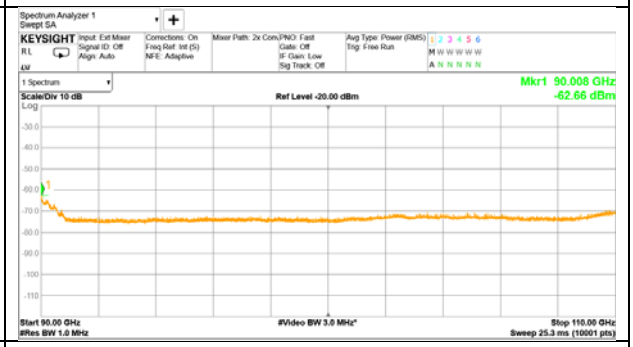
81 GHz - 83 GHz



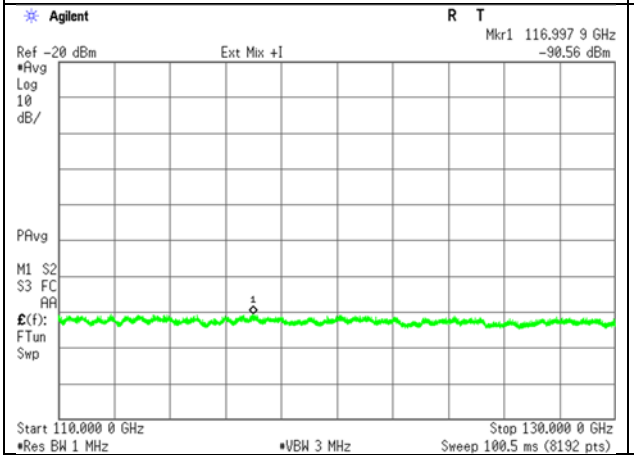
83 GHz - 90 GHz



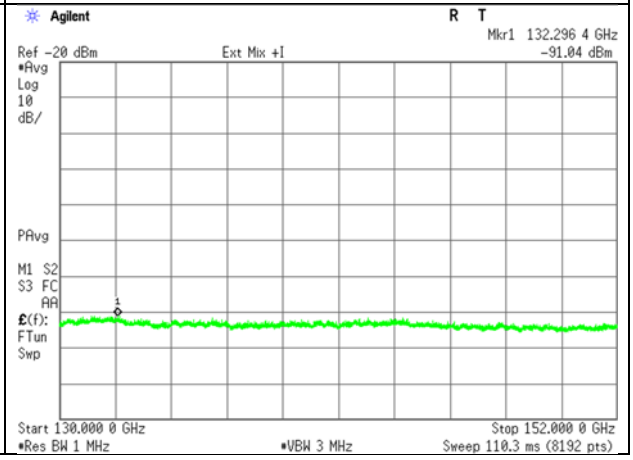
90 GHz - 110 GHz



110 GHz - 130 GHz

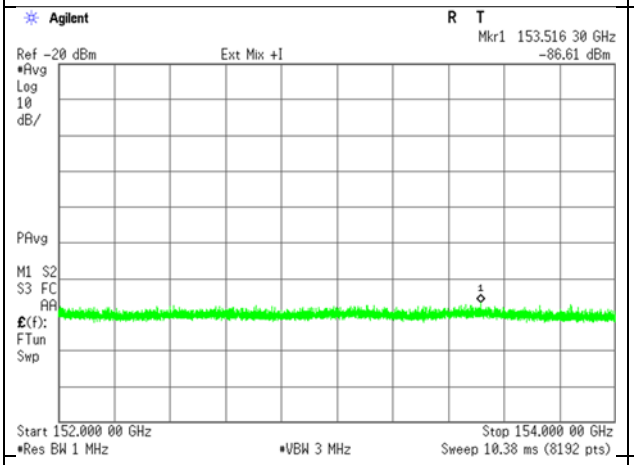


130 GHz - 152 GHz

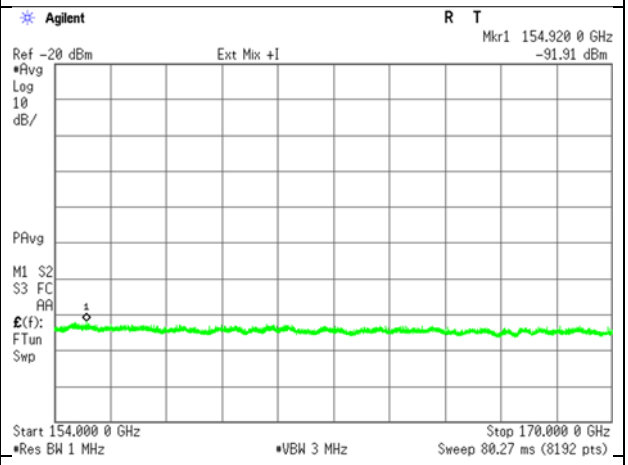


Field strength of spurious radiation
(above 40 GHz)

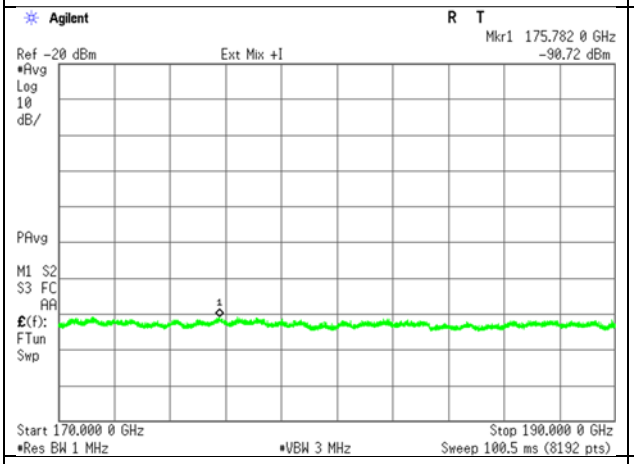
152 GHz - 154 GHz



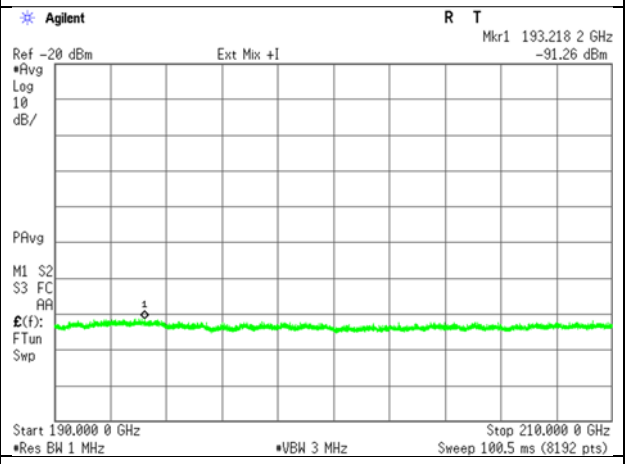
154 GHz - 170 GHz



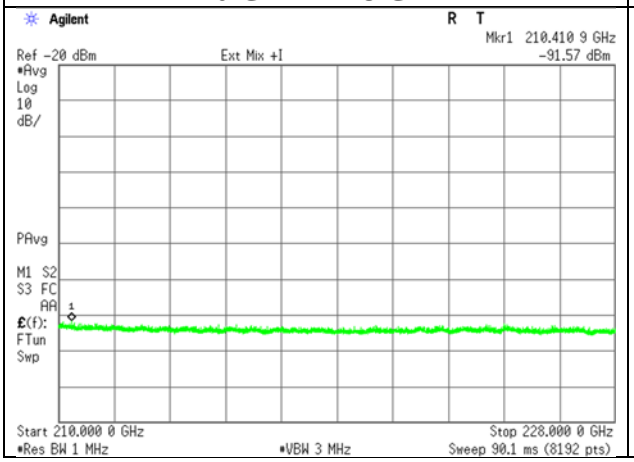
170 GHz - 190 GHz



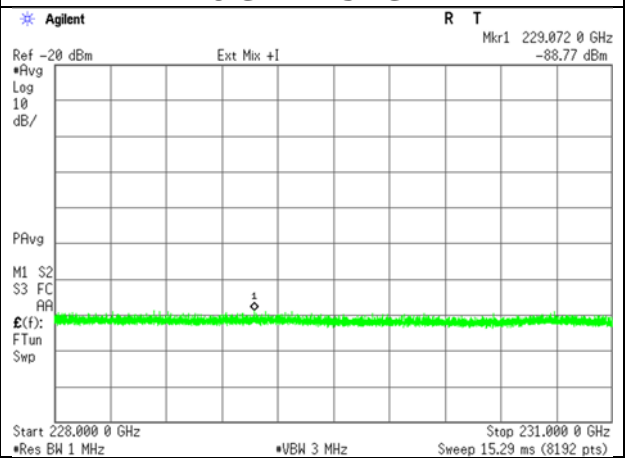
190 GHz - 210 GHz



210 GHz - 228 GHz



228 GHz - 231 GHz



Field strength of spurious radiation
(below 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	July 22, 2020	July 23, 2020	July 24, 2020
Temperature / Humidity	20 deg. C / 53 % RH	23 deg. C / 51 % RH	23 deg. C / 67 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	Above 10 GHz	1 GHz - 10 GHz	Below 1 GHz
Mode	Tx CW ch 2		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	45.017	QP	22.3	13.0	7.4	32.0	-	10.7	40.0	29.3	
Hori.	80.000	QP	28.0	6.9	7.9	32.0	-	10.8	40.0	29.2	
Hori.	183.380	QP	21.0	16.2	8.8	31.8	-	14.2	43.5	29.3	
Hori.	308.566	QP	21.0	13.7	9.8	31.8	-	12.7	46.0	33.3	
Hori.	572.113	QP	21.2	18.4	11.3	32.0	-	19.0	46.0	27.0	
Hori.	969.694	QP	19.9	22.3	13.2	30.7	-	24.7	54.0	29.4	
Vert.	45.017	QP	26.7	13.0	7.4	32.0	-	15.1	40.0	24.9	
Vert.	80.000	QP	30.5	6.9	7.9	32.0	-	13.3	40.0	26.7	
Vert.	183.380	QP	21.0	16.2	8.8	31.8	-	14.2	43.5	29.3	
Vert.	308.566	QP	21.1	13.7	9.8	31.8	-	12.8	46.0	33.2	
Vert.	572.113	QP	21.2	18.4	11.3	32.0	-	19.0	46.0	27.0	
Vert.	969.694	QP	19.9	22.3	13.2	30.7	-	24.7	54.0	29.4	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.50 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.54 dB
26.5 GHz - 40 GHz 20log (0.5 m / 3.0 m) = -15.56 dB

Field strength of spurious radiation (above 40 GHz)

Report No.	13408006H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No. 4	No. 4	No. 4
Date	July 20, 2020	July 21, 2020	July 23, 2020
Temperature / Humidity	20 deg. C / 60 % RH	22 deg. C / 57 % RH	26 deg. C / 41 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	40 GHz - 50 GHz	50 GHz - 75 GHz	75 GHz- 76 GHz
	83 GHz - 110 GHz	110 GHz - 231 GHz	81 GHz - 83 GHz
Mode	Tx CW ch 2		

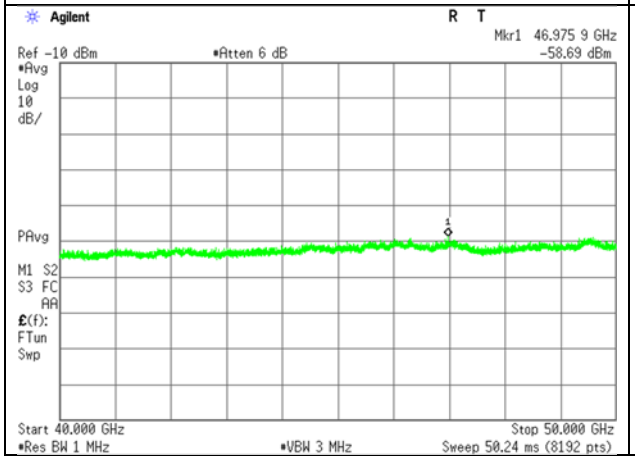
Freq.	Reading	Rx ant. gain	Filter loss	LNA gain	Mixer loss	IF amp. gain	IF cable loss	Meas. range *D*	FSL	EIRP		Power density at 3 m			Remarks
												Result	Limit	Margin	
[GHz]	[dBm]	[dBi]	[dB]	[dB]	[dB]	[dB]	[dB]	[m]	[dB]	[dBm]	[mW]	[pW/cm^2]	[pW/cm^2]	[dB]	
46.976	-58.69	22.10	0.00	33.17	0.00	0.00	8.65	1.0	65.88	-39.43	0.000114	0.10	600	37.75	
51.395	-77.02	22.93	0.00	26.17	46.60	31.77	0.12	1.0	66.66	-44.51	0.000035	0.03	600	42.82	
75.997	-68.32	23.05	0.00	0.00	-14.50	0.00	1.26	1.0	70.06	-34.56	0.000350	0.31	600	32.87	
81.029	-71.43	23.38	2.49	0.00	-12.40	0.00	2.33	0.5	64.59	-37.80	0.000166	0.15	600	36.11	
83.676	-55.59	23.56	2.21	32.16	0.00	0.00	0.00	1.0	70.89	-38.21	0.000151	0.13	600	36.52	
90.022	-62.76	23.89	0.77	33.43	0.00	0.00	0.00	1.0	71.53	-47.79	0.000017	0.01	600	46.10	
117.096	-90.37	22.54	0.00	18.35	56.69	0.00	0.00	0.01	33.81	-40.76	0.000084	0.07	600	39.07	
131.313	-90.75	22.98	0.00	20.06	52.82	0.00	0.00	0.01	34.81	-46.17	0.000024	0.02	600	44.48	
153.006	-86.92	23.35	0.00	18.20	56.67	0.00	0.00	0.01	36.14	-35.66	0.000272	0.24	600	33.98	
154.719	-91.96	23.37	0.00	17.80	56.92	0.00	0.00	0.01	36.23	-39.98	0.000100	0.09	600	38.30	
171.358	-90.90	22.43	0.00	0.00	59.06	0.00	0.00	0.01	37.12	-17.15	0.019275	17.0	600	15.47	
193.738	-90.58	22.91	0.00	0.00	56.26	0.00	0.00	0.01	38.19	-19.04	0.012468	11.0	600	17.36	
212.655	-91.69	23.19	0.00	0.00	57.72	0.00	0.00	0.01	39.00	-18.17	0.015245	13.5	1000	18.70	
230.109	-88.70	23.35	0.00	0.00	63.41	0.00	0.00	0.01	39.68	-8.96	0.127071	112.4	1000	9.49	

Calculation:

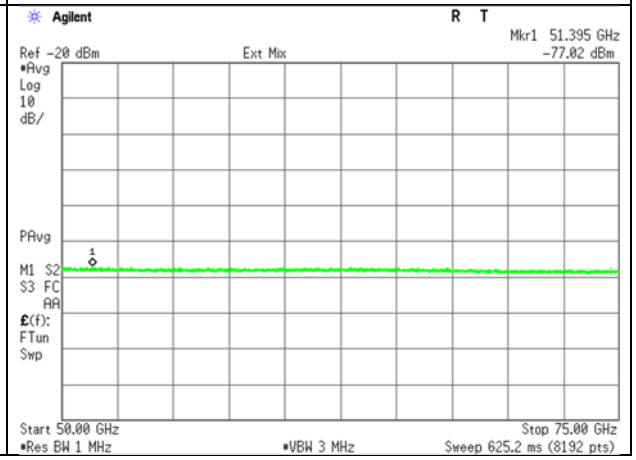
FSL (Free Space path Loss) = 10 * log (($4 * Pi * D / \lambda$)^2)
EIRP = Reading - Rx ant. gain + Filter loss - LNA gain + Mixer loss - IF amp. gain + IF cable loss + FSL
Power density Result at 3 m = EIRP / (4 * Pi * 300^2)

These calculation results are same as results which were calculated with formulas described in the Section 9 of ANSI C63.10-2013.
The equipment were not used for factor 0 dB of the data sheets.

40 GHz – 50 GHz

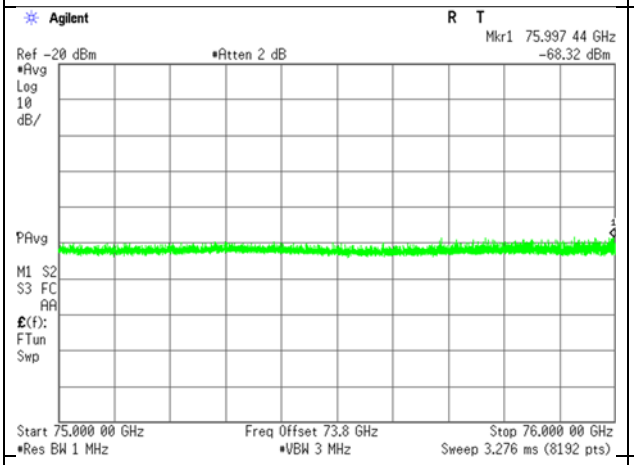


50 GHz – 75 GHz

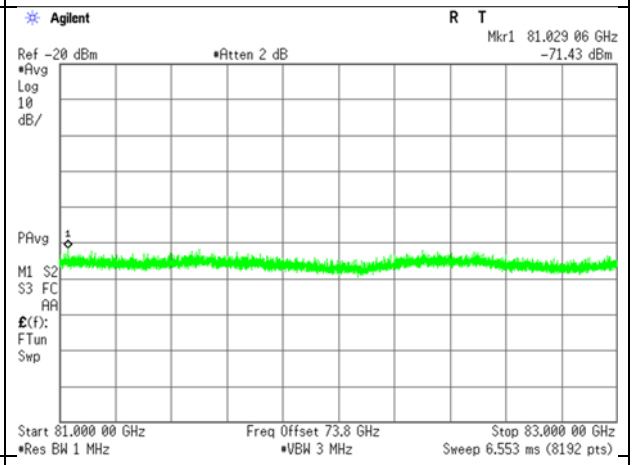


Field strength of spurious radiation
(above 40 GHz)

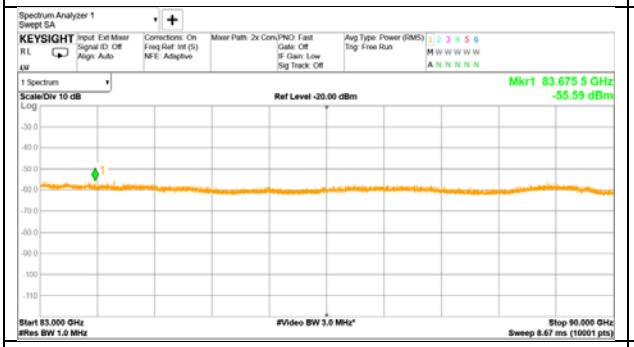
75 GHz - 76 GHz



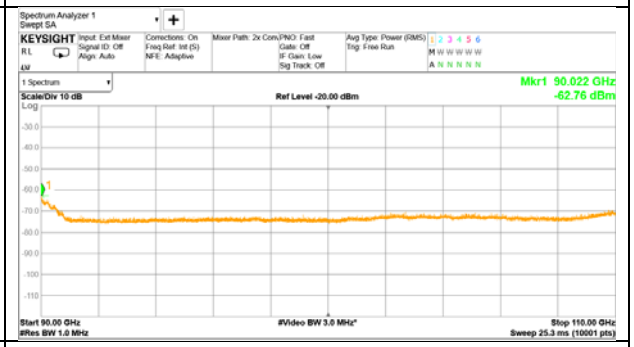
81 GHz - 83 GHz



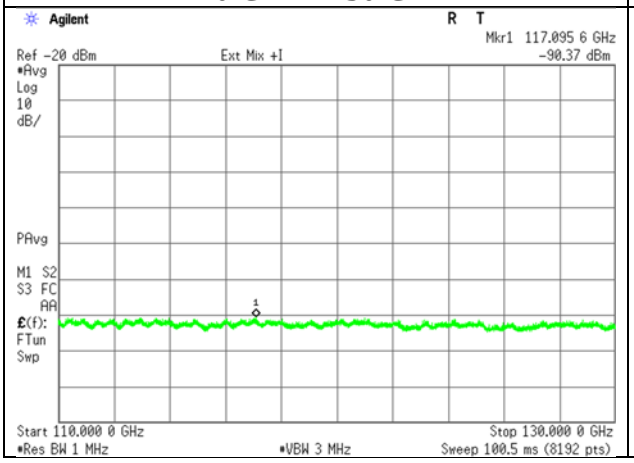
83 GHz - 90 GHz



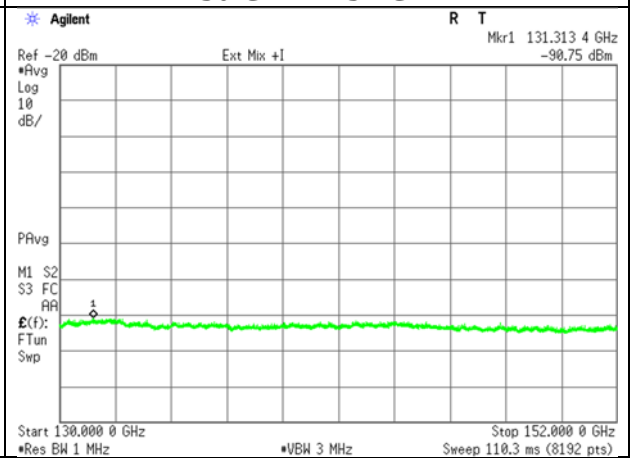
90 GHz - 110 GHz



110 GHz - 130 GHz

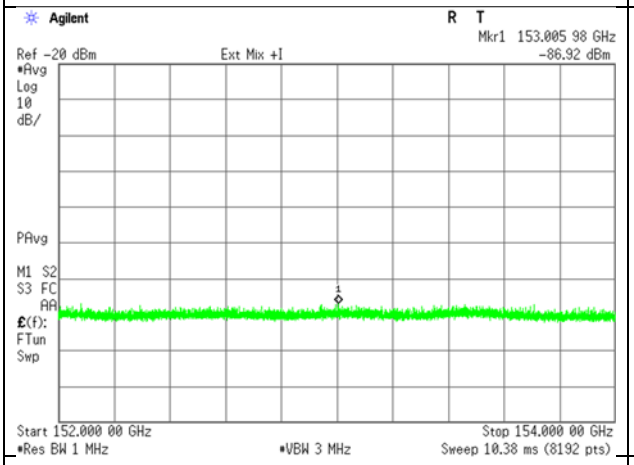


130 GHz - 152 GHz

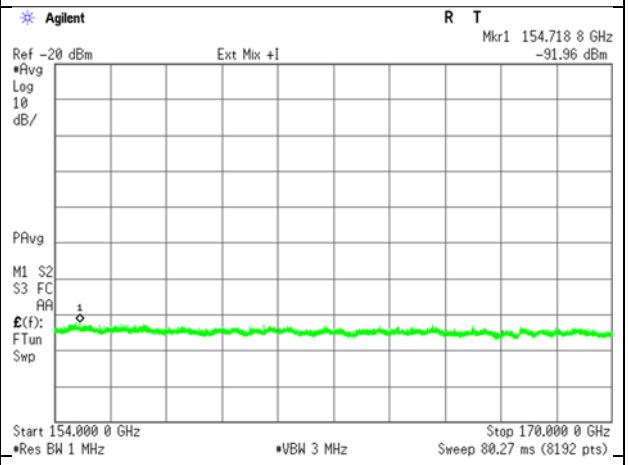


Field strength of spurious radiation
(above 40 GHz)

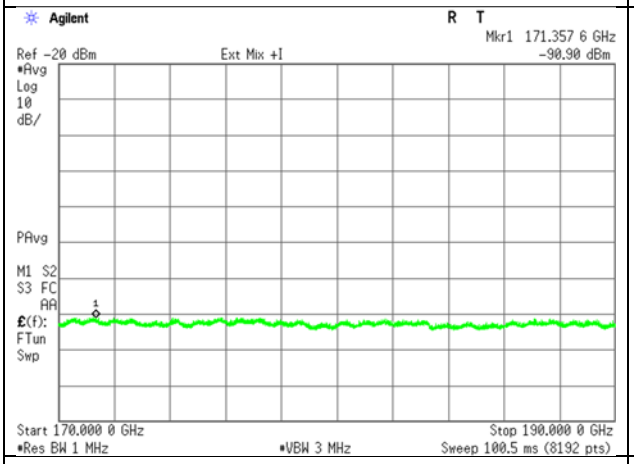
152 GHz - 154 GHz



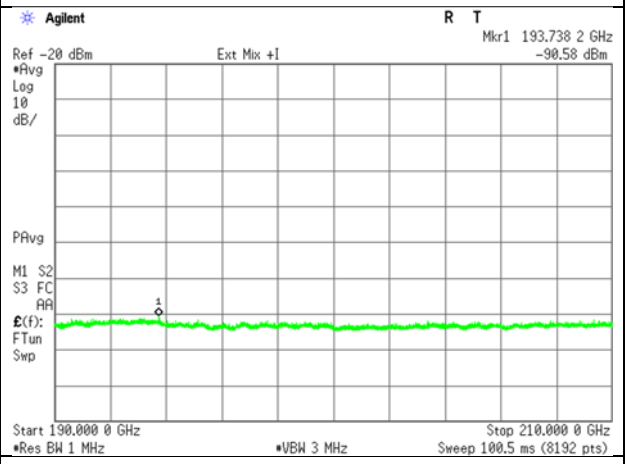
154 GHz - 170 GHz



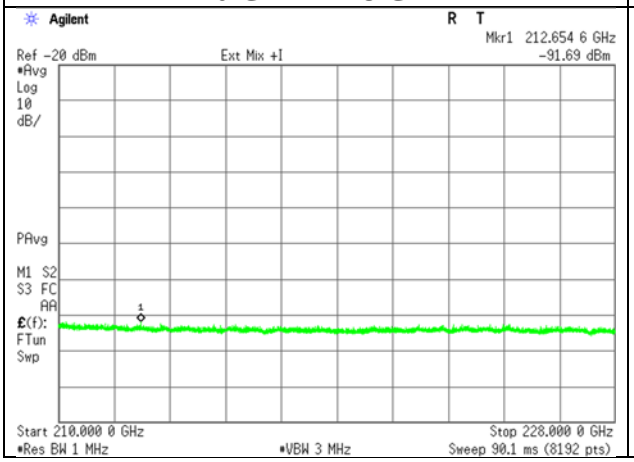
170 GHz - 190 GHz



190 GHz - 210 GHz



210 GHz - 228 GHz



228 GHz - 231 GHz