

12. OCCUPIED BANDWIDTH

12.1 Operating environment

Temperature	:	24 °C
Relative humidity	:	48 % R.H.

12.2 Test set-up

The emission bandwidth (×dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated × dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least $3\times$ the resolution bandwidth. When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3×RBW.



12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
-	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Jul. 24, 2019 (1Y)
■ -	AAMCS-UDC	AA-MCS	Directional Coupler	400	Jul. 25, 2019 (1Y)
-	MT8821C	ANRITSU	Radio Communication Analyzer	6261849029	Jul. 26, 2019 (1Y)
-	GP-4303D	LG Precision Co.,Ltd	DC Power Supply	5071069	Jan. 10, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



12.4 Test data

12.4.1 Test data for LTE Band 4

-. Test Date : August 05, 2019 ~ August 23, 2019

Test Result	: Pass			
Test Mode	Channel	26 dB Bandwidth99 % Occupied Bandwidth(MHz)(MHz)		Result
QPSK	Low	1.598	1.159	PASS
	Middle	1.578	1.139	PASS
	High	1.618	1.139	PASS

Test Mode	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
	Low	1.698	1.159	PASS
16QAM	Middle	1.658	1.139	PASS
	High	1.678	1.179	PASS

Tested by: Ju Yun Park / Assistant Manager











Page 46 of 81

12.4.2 Test data for LTE Band 12

-. Test Date : August 05, 2019 ~ August 23, 2019

Test Result	: Pass			
Test Mode	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
QPSK	Low	1.598	1.139	PASS
	Middle	1.638	1.159	PASS
	High	1.598	1.139	PASS

Test Mode	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
	Low	1.638	1.179	PASS
16QAM	Middle	1.638	1.179	PASS
	High	1.679	1.179	PASS

Tested by: Ju Yun Park / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)











Page 49 of 81

12.4.3 Test data for LTE Band 13

-. Test Date : August 05, 2019 ~ August 23, 2019

-. Test Result

• Pass

. Test Result	• I u bb			
Test Mode	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
QPSK	Low	1.618	1.159	PASS

Test Mode	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
16QAM	Low	1.618	1.159	PASS

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Tested by: Ju Yun Park / Assistant Manager







13. Conducted Band Edge

Temperature	:	24 °C
Relative humidity	:	48 % R.H.

13.2 Test set-up



(Configuration of conducted Emission measurement)

Conducted Spurious Emissions is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 6.

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. All

measurements were done at 3 channels(low, middle and high operational range.)

The Conducted Spurious Emissions used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

13.3 Methods of Measurement

- 1. All measurements were done at low and high operational frequency range.
- 2. Set spectrum analyzer with RMS detector.
- 3. The center frequency of spectrum is the band edge frequency and set RBW of the spectrum is 20 kHz

and VBW of the spectrum is 50 kHz $\,$



13.4 Limits

LTE -4 Rule Part 27.53(h) specifies that "for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB."

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 +10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

LTE -13 Rule Part 27.53(f)For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

TE Band 4 / 12 Limit				
Limit	-13 dBm			
LTE Band 13 Limit				
Limit out of the band 1559-1610 MHz	-13 dBm			
Limit in the band 1559-1610 MHz	-40 dBm			

13.5 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Jul. 24, 2019 (1Y)
■ -	AAMCS-UDC	AA-MCS	Directional Coupler	400	Jul. 25, 2019 (1Y)
■ -	MT8821C	ANRITSU	Radio Communication Analyzer	6261849029	Jul. 26, 2019 (1Y)
■ -	GP-4303D	LG Precision Co.,Ltd	DC Power Supply	5071069	Jan. 10, 2019 (1Y)

All test equipment used is calibrated on a regular basis.



13.6 Test data

13.6.1 Test data for LTE Band 4

-. Test Date

: Pass

: August 05, 2019 ~ August 23, 2019

-. Test Result

LTE Band 4 QPSK

Test Mode	Channel	Edge Frequency (MHz)	MEASURED VLAUE (dBm)	Limit (dBm)	Result
	Low	1 710.000 0	-40.93	-13.00	PASS
1 RB	High	1 755.000 0	-41.44	-13.00	PASS
	Low	1 710.000 0	-37.22	-13.00	PASS
6 RB	High	1 755.000 0	-37.12	-13.00	PASS

LTE Band 4 16QAM

Test Mode	Channel	Edge Frequency (MHz)	MEASURED VLAUE (dBm)	Limit (dBm)	Result
	Low	1 710.000 0	-40.03	-13.00	PASS
1 RB	High	1 755.000 0	-42.04	-13.00	PASS
	Low	1 710.000 0	-35.17	-13.00	PASS
6 RB	High	1 755.000 0	-35.56	-13.00	PASS

Tested by: Ju Yun Park / Assistant Manager



13.6.2 Test data for LTE Band 4 QPSK





13.6.3 Test data for LTE Band 4 16QAM





Page 56 of 81

13.6.4 Test data for LTE Band 12

-. Test Date : August 05, 2019 ~ August 23, 2019

-. Test Result

: Pass

LTE Band 12 QPSK

Test Mode	Channel	Edge Frequency	MEASURED VLAUE	Limit (dBm)	Result
		(11112)	(ubiii)	(uDiii)	
	Low	699.000 0	-43.21	-13.00	PASS
1 RB	High	716.000 0	-42.23	-13.00	PASS
	Low	699.000 0	-38.29	-13.00	PASS
6 RB	High	716.000 0	-36.15	-13.00	PASS

LTE Band 12 16QAM

Test Mode	Channel	Edge Frequency	MEASURED VLAUE	Limit	Result
rest mode	Chaimer	(MHz)	(dBm)	(dBm)	Robuit
	Low	699.000 0	-42.39	-13.00	PASS
1 RB	High	716.000 0	-45.87	-13.00	PASS
	Low	699.000 0	-35.53	-13.00	PASS
6 RB	High	716.000 0	-33.24	-13.00	PASS

Tested by: Ju Yun Park / Assistant Manager



13.6.5 Test data for LTE Band 12 QPSK





13.6.6 Test data for LTE Band 12 16QAM





Page 59 of 81

13.6.7 Test data for LTE Band 13

-. Test Date : August 05, 2019 ~ August 23, 2019

-. Test Result

: Pass

LTE Band 13 QPSK

Test Mode	Channel	Edge Frequency (MHz)	MEASURED VLAUE	Limit (dBm)	Result
		()	(0)	()	
	Low	777.000 0	-43.63	-13.00	PASS
1 RB	High	787.000 0	-41.53	-13.00	PASS
	Low	777.000 0	-39.53	-13.00	PASS
6 RB	High	787.000 0	-36.94	-13.00	PASS

LTE Band 13 16QAM

Test Mode	Channel	Edge Frequency	MEASURED VLAUE	Limit	Result
10000	Chieffer	(MHz)	(dBm)	(dBm)	Tresure
	Low	777.000 0	-41.91	-13.00	PASS
1 RB	High	787.000 0	-45.86	-13.00	PASS
	Low	777.000 0	-36.47	-13.00	PASS
6 RB	High	787.000 0	-34.42	-13.00	PASS

Tested by: Ju Yun Park / Assistant Manager



13.6.8 Test data for LTE Band 13 QPSK





13.6.9 Test data for LTE Band 13 16QAM





14. Conducted Spurious and Harmonic Emissions at Antenna Termianl

14.1 Operating environment

Temperature	:	24 °C	
Relative humidity	:	48 % R.H.	

14.2 Test set-up



(Configuration of conducted Emission measurement)

Conducted Spurious Emissions is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 6.

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. All

measurements were done at 3 channels(low, middle and high operational range.)

The Conducted Spurious Emissions used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

Conducded spurious emissions

The EUT was setup to maximum output power. The 100 kHz RBW and 300 kHz VBW was used to scan from 30 MHz to 1 GHz. Also, the 1 MHz RBW and 3 MHz VBW was used to scan from 1 GHz to 20 GHz. The high, low and a middle channel were tested for out of band measurements.



14.3 Limits

LTE -4 Rule Part 27.53(h) specifies that "for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB."

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 +10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

LTE -13 Rule Part 27.53(f)For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

LTE Band 4 / 12 Limit	
Limit	-13 dBm
LTE Band 13 Limit	
Limit out of the band 1559-1610 MHz	-13 dBm
Limit in the band 1559-1610 MHz	-40 dBm

14.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Jul. 24, 2019 (1Y)
■ -	AAMCS-UDC	AA-MCS	Directional Coupler	400	Jul. 25, 2019 (1Y)
■ -	MT8821C	ANRITSU	Radio Communication Analyzer	6261849029	Jul. 26, 2019 (1Y)
■ -	GP-4303D	LG Precision Co.,Ltd	DC Power Supply	5071069	Jan. 10, 2019 (1Y)

All test equipment used is calibrated on a regular basis.



14.5 Test data

14.5.1 Test data for LTE Band 4 QPSK













14.5.2 Test data for LTE Band 4 16OAM

	- n l								
Doftow	m	Offcot	10 F6 d0 🔿	DDW 100 k					
Att	el 20.00 dBm 30 dB	SWT	30.1 ms 👄	VBW 300 k	HZ HZ Mode	Sween			
SGL Coun	t 300/300		0011110	1011 000 K	ine mode	oweeb			
⊖1Rm Avgl	Pwr								
					М	1[1]		-	55.98 dBm
						I	i i	877	.2180 MHz
10 dBm									
0 dBm									
-10 dBm—		10-1							
	-DI -13.000	asm							
-20 dBm—									
-30 dBm—									
-40 dBm—									
-50 dBm									
So abii								M1	
BUL dura		-						and the second	
-00 aBm									
70 do									
-/0 dBm-									
Start 30.0) MHz	1	1	3000	1 pts	1	1	Sto	p 1.0 GHz
				Low C	hannel				
Spectru	m	Offset	12.52 dB 🖷	Low C	hannel				
Spectrui Ref Leve	m al 20.00 dBm 30 dB	Offset SWT	12.52 dB 👄 57 ms 👄	Low C	² hannel ² Mode S	Sweep			
Spectrue Ref Leve Att SGL Coun	m el 20.00 dBm 30 dB t 300/300	Offset SWT	12.52 dB 🖷 57 ms 🖷	Low C RBW 1 MHz VBW 3 MHz	² ² Mode S	Sweep			
Spectrui Ref Leve Att SGL Coun IRm Avgl	m el 20.00 dBm 30 dB t 300/300 Pwr	Offset SWT	12.52 dB 👄 57 ms 👄	Low C	² ² Mode S)weep			
Spectrue Ref Leve Att SGL Coun	m el 20.00 dBm 30 dB t 300/300 Pwr	Offset SWT	12.52 dB 👄 57 ms 👄	Low C	2 2 Mode S	Weep 1[1]			(▼ 33.92 dBm 12920 GHz
Spectrue Ref Leve Att SGL Coun IRm Avgi	m el 20.00 dBm 30 dB t 300/300 Pwr	Offset SWT	12.52 dB ● 57 ms ●	Low C RBW 1 MHz VBW 3 MHz	^z Mode s	weep 1[1]		- 19.9	₩ 33.92 dBm 12920 GHz
Spectrui Ref Leve SGL Coun IRm Avgi	m	Offset SWT	12.52 dB 👄 57 ms 👄	Low C	Mode S	weep 1[1]		- 19.9	₩ 33.92 dBm 12920 GHz
Spectrui Ref Leve SGL Coun IRm Avgi	m 30 dB 30 dB t 300/300 Pwr	Offset SWT	12.52 dB 🖷 57 ms 🖷	Low C	Mode S	weep 1[1]		- 19.9	₩ 33.92 dBm 12920 GHz
Spectrui Ref Leva Att SGL Coun 1Rm Avgi 10 dBm	m 30 dB t 300/300 Pwr	Offset SWT	12.52 dB 🖷 57 ms 👄	Low C	² ² Mode S	weep 1[1]		- 19.9	₩ 33.92 dBm 12920 GHz
Spectrui Ref Leva Att SGL Coun 10 dBm- 0 dBm-	m 30 dB t 300/300 Pwr	Offset SWT	12.52 dB 🖷 57 ms 🖷	Low C	Mode S	weep 1[1]			₩ 33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dBm- -10 dBm-	n 30 dB 30 dB 1 20.00 dBm 30 dB 200/300 Pwr D1 -13.000	dBm	12.52 dB 🖷 57 ms 🖷	Low C	Mode S	weep 1[1]			₩ 33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dBm- -10 dBm-	n 30 dB 30 dD 20.00 JBm 30 dD 2007 2007 2007 2007 2007 2007 2007 200	dBm	12.52 dB e 57 ms e	Low C	Mode S	weep		- 19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dBm- -10 dBm- -20 dBm-	n 30 dB 30 dD 20.00 JBm 30 dD 2007 2007 2007 2007 2007 2007 2007 200	dBm	12.52 dB e 57 ms e	Low C	Mode S	Sweep		- 19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dBm- -10 dBm- -20 dBm-	n 30 dB 30 dD 20.00 JBm 30 dD 2007 2007 2007 2007 2007 2007 2007 200	dBm	12.52 dB • 57 ms •	Low C	Mode S	Sweep		- 19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dBm- -10 dBm- -20 dBm- -30 dBm-	n 30 dB 30 dD 20.00 dBm 30 dD 2007 2007 2007 2007 2007 2007 2007 200	dBm	12.52 dB • 57 ms •	Low C	Mode S	Sweep		- 19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm	m 30 dB 30 dB 1 20.00 dBm 30 dB 200/300 2007	dBm	12.52 dB • 57 ms •	Low C	Mode S	Sweep			33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 d6m- -10 dBm- -20 dBm- -30 dBm-	m	dBm	12.52 dB • 57 ms •	Low C	Mode S	Weep		19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 d6m- -10 dBm- -20 dBm- -30 dBm-	m	dBm	12.52 dB • 57 ms •	Low C	Mode S	Weep		19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dEm- -10 dBm- -20 dBm- -30 dBm- -30 dBm-	m	dBm	12.52 dB • 57 ms •	RBW 1 MHA VBW 3 MHA	Mode S	weep		19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm	m	dBm	12.52 dB • 57 ms •	Low C	Mode S	weep			33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dEm- -10 dBm- -20 dBm- -30 dBm- -30 dBm- -50 dBm- -50 dBm-	m	dBm	12.52 dB • 57 ms •	Low C	Mode S	weep		- 19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm	m	dBm	12.52 dB • 57 ms •	Low C	² Mode S	weep		- 19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm	m	dBm	12.52 dB • 57 ms •	Low C	^z Mode S	weep		- 19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dBm- -10 dBm- -20 dBm- -20 dBm- -30 dBm- -50 dBm- -60 dBm-	m	dBm	12.52 dB • 57 ms •	Low C	Z Mode S Mode S Mode S	weep		- 19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dBm- -10 dBm- -20 dBm- -30 dBm- -30 dBm- -50 dBm- -50 dBm- -70 dBm-	n	dBm	12.52 dB • 57 ms •	Low C	hannel	weep		- 19.9	33.92 dBm 12920 GHz
Spectrui Ref Levi Att SGL Coun 10 dBm- 0 dBm- -10 dBm- -20 dBm- -30 dBm- -40 dBm- -50 dBm- -70 dBm- Start 1.0	m	dBm	12.52 dB • 57 ms •	Low C	Mode S	weep			33.92 dBm 12920 GHz



Page 68 of 81

Report No. : OT-199-RWD-006









14.5.3 Test data for LTE Band 12 QPSK

<u> </u>								
Spectrun	י 🕒							
Ref Leve	20.00 dBm	Offset :	10.23 dB 😑	RBW 100 k	Hz			
Att	30 dB	SWT	30.1 ms 👄	VBW 300 k	Hz Mode	Sweep		
SGL Count	300/300							
⊖1Rm AVgP	wr		1					
					M	1[1]		55.22 dBm
10 d0m							091	
TO UBIII								
0 dBm								
-10 dBm								
	D1 -13.000	dBm						
00 d0m								
-20 ubiii								
-30 dBm								
-40 dBm—								
50 d2-5								
-30 aBm						M		
-ou asm								
-70 dBm								
Start 30.0	MHz			3000	1 pts		Sto	p 1.0 GHz
				Low C	hannel			
	_			Low C	hannel			
Spectrun	ı)			Low C	hannel			
Spectrun Ref Leve	ר 20.00 dBm	Offset	11.31 dB 👄	Low C	hannel			
Spectrun Ref Leve Att	ר 1 20.00 dBm 30 dB	Offset : SWT	11.31 dB 👄 30.1 ms 🖷	Low C	hannel	weep		
Spectrun Ref Leve Att SGL Count	1 20.00 dBm 30 dB 300/300	Offset : SWT	11.31 dB 🖷 30.1 ms 🖶	Low C	hannel ² Mode S	weep		
Spectrun Ref Leve Att SGL Count 9 1Rm AvgP	1 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB 👄 30.1 ms 👄	Low C	hannel ² Mode S	weep		
Spectrun Ref Leve Att SGL Count O 1Rm AvgP	1 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB 👄 30.1 ms 👄	Low C	hannel Mode S	weep 1[1]		(₩ ▼ 37.97 dBm
Spectrun Ref Leve Att SGL Count	1 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB 🖷 30.1 ms 🖷	Low C RBW 1 MHz VBW 3 MHz	hannel ² Mode S M	weep	6.9	(₩ ⊽ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IRm AvgP	1 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB 🖷 30.1 ms 🖷	Low C RBW 1 MHz VBW 3 MHz	hannel ² Mode S M	weep 1[1]	 6.9	(₩ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count @IRm AvgP	1 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB 🖷 30.1 ms 🖷	Low C RBW 1 MHz VBW 3 MHz	hannel ² Mode S M	weep 1[1]	 - 6.9	(₩ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IRm AvgP	1 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB 🖷 30.1 ms 🖷	Low C	Mode S	weep 1[1]	- 6.9	(₩ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IRm AvgP	1 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB 🖷 30.1 ms 🖷	Low C	Mode S	weep 1[1]	6.9	(▼ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IRm AvgP 10 dBm	1 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB 🖷 30.1 ms 🖷	Low C	Mode S	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IRm AvgP 10 dBm	1 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB • 30.1 ms •	Low C	Mode S	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve > Att SGL Count • 1Rm AvgP 10 dBm	D 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB • 30.1 ms •	Low C	Mode S	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count 10 dBm- 0 dBm- -10 dBm- -20 dBm-	D 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB	Low C	Mode S	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count 10 dBm	D 20.00 dBm 30 dB 300/300 wr	Offset : SWT	11.31 dB • 30.1 ms •	Low C	Mode S	weep	6.9	(₩ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count 10 dBm- 0 dBm- -10 dBm- -20 dBm-	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB • 30.1 ms •	Low C	Mode S	weep	6.9	(₩ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count 10 dBm- 0 dBm- -10 dBm- -20 dBm- -30 dBm-	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB 30.1 ms	Low C	Mode S	weep 1[1]	6.9	(₩ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count ID dBm 0 dBm -10 dBm -20 dBm -30 dBm	D 20.00 dBm 300/300 wr D1 -13.000	dBm-	11.31 dB	Low C	hannel	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IRm AvgP 10 dBm	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB • 30.1 ms •	Low C	hannel	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IN AvgP 10 dBm	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB • 30.1 ms •	Low C	hannel	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count 10 dBm	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB • 30.1 ms •	Low C	hannel	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count ID dBm	D1 -13.000	dBm	11.31 dB • 30.1 ms •	Low C	hannel	weep	6.9	(₩ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count ID dBm	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB • 30.1 ms •	Low C	hannel	Weep	6.9	(₩ 37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IRm AvgP 10 dBm	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB 30.1 ms	Low C	hannel	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IRm AvgP 10 dBm	D 20.00 dBm 30 dB 300/300 wr	dBm-	11.31 dB	Low C	hannel	Weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count IRm AvgP 10 dBm	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB • 30.1 ms •	Low C	hannel	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count ID dBm	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB • 30.1 ms •	Low C	hannel	weep	6.9	37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count 10 dBm	D 20.00 dBm 30 dB 300/300 wr	dBm	11.31 dB • 30.1 ms •	Low C	hannel	weep	6.9	(37.97 dBm 54950 GHz
Spectrun Ref Leve Att SGL Count ID dBm	D 20.00 dBm 30 dB 300/300 wr D1 -13.000	dBm	11.31 dB • 30.1 ms •	Low C	hannel	Weep	- 6.9	(37.97 dBm 54950 GHz











14.5.4 Test data for LTE Band 12 16QAM

	n I							
Poflow	"	Offcot	10.22 dB 👄	DDW 100 k	LI-7			(∀
Att	30 dB	SWT	30.1 ms 👄	VBW 300 k	Hz Mode	Sweep		
SGL Count	: 300/300							
⊜1Rm AvgF	'wr							
					M	(II) -	- 883	56.66 dBm .0700 MHz
10 dBm—							 	
0 dBm								
-10 dBm—							 	
	D1 -13.000	dBm						
-20 dBm—							 	
-30 dBm—								
-40 dBm—							 	
-50 dBm—			ļ				 	
						1	M1	
-60 dBm						and product of the local division of the loc		
-70 dBm—							 	
01	NALL-			0000	1		01-	- 1 0 011-
start 30.0	MHZ			3000	1 pts		510	p 1.0 GHZ
				Law	1 1			
				Low C	hannel			_
Spectrur	n			Low C	hannel			
Spectrur Ref Leve	n I 20.00 dBm	n Offset	11.31 dB 🕳	Low C	² hannel			
Spectrur Ref Leve	n 1 20.00 dBm 30 dB	n Offset 8 SWT	11.31 dB 🖷 30.1 ms 🖷	Low C	^z ^z Mode S	weep		
Spectrur Ref Leve Att SGL Count	n 1 20.00 dBm 30 dB : 300/300	n Offset 8 SWT	11.31 dB 🖷 30.1 ms 🖶	Low C RBW 1 MH2 VBW 3 MH2	² hannel ² Mode S	weep	 	
Spectrur Ref Leve Att SGL Count	n 1 20.00 dBm 30 dE : 300/300	0 Offset 8 SWT	11.31 dB 👄 30.1 ms 👄	Low C	hannel ² Mode Si	weep		(₩ ▼ 37.70 dBm
Spectrur Ref Leve Att SGL Count	n 1 20.00 dBm 30 dE : 300/300 Iwr	Offset 3 SWT	11.31 dB 🖷 30.1 ms 🖷	Low C RBW 1 MHa VBW 3 MHa	'hannel ² Mode S	weep	 - 6.9	(₩ 7 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count IRm AvgF	n 1 20.00 dBm 30 dE 300/300 !wr	o Offset 3 SWT	11.31 dB ● 30.1 ms ●	Low C	² Mode S	weep	- 6.9	(▼ 37.70 dBm 61850 GHz
Spectrur Ref Leva Att SGL Count 1Rm AvgF	n	n Offset 3 SWT	11.31 dB 🖷 30.1 ms 🖶	Low C	² Mode S	weep	- 6.9	(▼ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count 110 dBm 10 dBm 0 dBm	n 1 20.00 dBm 30 dE 300/300 'wr	o Offset 3 SWT	11.31 dB 🖷 30.1 ms 🖷	Low C	Mode S	weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count 10 dBm 10 dBm 0 dBm	n	o Offset 3 SWT	11.31 dB ● 30.1 ms ●	Low C RBW 1 MHa VBW 3 MHa	Mode S	weep	- 6.9	₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count IRm Avgf 10 dBm	n 30 dBm	SWT	11.31 dB	Low C RBW 1 MH: VBW 3 MH:	Mode S	weep	6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count IRm Avgf 10 dBm	n 30 dB 300/300 Wr D1 -13.000	dBm	11.31 dB	Low C	Mode S	weep	6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count In Avgf 10 dBm 0 dBm -10 dBm -20 dBm	n 30 dB 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	Mode S	weep	6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count 10 dBm 10 dBm -10 dBm -20 dBm	n 30 dBr 30 dBr 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	Mode S	weep	6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count 10 dBm 10 dBm -10 dBm -20 dBm -30 dBm	n 30 dBr 30 dBr 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	Mode S	weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count IN Avgf 10 dBm -10 dBm -20 dBm -30 dBm	n 30 dBr 30 dE 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	Mode S	weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count 10 dBm 10 dBm -10 dBm -20 dBm -30 dBm -40 dBm	n 30 dBr 30 dE 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	Mode S	Weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count 10 dBm 10 dBm -10 dBm -20 dBm -30 dBm -40 dBm	n 30 dBr 30 dE 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	Mode S	weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Coun' IRm Avgf 10 dBm- 0 dBm- -10 dBm- -20 dBm- -30 dBm- -30 dBm-	n 30 dBr 30 dE 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	Mode S	weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Couni 10 dBm- 10 dBm- -10 dBm- -20 dBm- -30 dBm- -40 dBm-	n 30 dBr 30 dE 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	Mode S	weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Coun' 10 dBm- 0 dBm- -10 dBm- -20 dBm- -30 dBm- -30 dBm- -50 dBm- -50 dBm-	n 30 dBr 30 dE 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	'hannel	weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Coun' IRm Avgf 10 dBm- 0 dBm- -10 dBm- -20 dBm- -30 dBm- -30 dBm- -50 dBm- -60 dBm-	n 30 dBr 30 dE 300/300 'wr	dBm	11.31 dB • 30.1 ms •	Low C	'hannel	Weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Coun' IRm Avgf 10 dBm- 0 dBm- -10 dBm- -20 dBm- -30 dBm- -30 dBm- -50 dBm- -60 dBm-	n 30 dBr 30 dBr 30 dV WWr 	dBm	11.31 dB • 30.1 ms •	Low C	² Mode S	weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count IRm Avgf 10 dBm- 0 dBm- -10 dBm- -20 dBm- -30 dBm- -30 dBm- -50 dBm- -60 dBm- -70 dBm-	n 30 dBr 30 dBr 30 dDr wwr	dBm	11.31 dB • 30.1 ms •	Low C	² Mode S	weep	- 6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count IRm Avgf 10 dBm— 0 dBm— -10 dBm— -20 dBm— -30 dBm— -30 dBm— -50 dBm— -60 dBm—	n 30 dBr 30 dBr 30 dPr wwr	dBm	11.31 dB • 30.1 ms •	Low C	² Mode S	weep	6.9	(₩ 37.70 dBm 61850 GHz
Spectrur Ref Leve Att SGL Count 10 dBm 0 dBm -10 dBm -20 dBm -20 dBm -30 dBm -30 dBm -50 dBm -50 dBm -70 dBm	n 30 dBr 30 dBr 30 dZ wr -D1 -13,000	dBm	11.31 dB • 30.1 ms •	Low C	hannel	weep	- 6.9	(37.70 dBm 61850 GHz 10.0 GHz



Page 74 of 81

Report No. : OT-199-RWD-006









14.5.5 Test data for LTE Band 13 QPSK





14.5.6 Test data for LTE Band 13 16QAM





15. FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

15.1 Operating environment

Temperature	:	24 °C
Relative humidity	:	48 % R.H.

15.2 Test set-up

1. Frequency Stability (Voltage Variation)

+20 °C temperature and $\pm 15\%$ supply voltage variations. If a product is specified to operate over a range of input voltage then the -15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

(1) Vary primary supply voltage from $\pm 15\%$ of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point which shall be specified by the manufacturer.

2. Frequency Stability (Temperature Variation)

Turn EUT off and set chamber temperature to -30 °C and then allow sufficient time (approximately 20 to 30 minutes after chamber reach the assigned temperature) for EUT to stabilize. Turn ON EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -30 °C to +50 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.

15.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
-	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Jul. 24, 2019 (1Y)
■ -	AAMCS-UDC	AA-MCS	Directional Coupler	400	Jul. 25, 2019 (1Y)
■ -	MT8821C	ANRITSU	Radio Communication Analyzer	6261849029	Jul. 26, 2019 (1Y)
-	PSL-2KP	ESPEC	Environmental Test Chamber	14009407	Feb. 22, 2019 (1Y)
-	GP-4303D	LG Precision Co.,Ltd	DC Power Supply	5071069	Jan. 10, 2019 (1Y)

All test equipment used is calibrated on a regular basis.



15.4 Test data

15.4.1 Test data for Voltage(V)_LTE Band 4

Temperature(°C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
	12.0		1 732 500 011	0.006 3
20	10.2	1 732 500 000	1 732 500 008	0.004 6
	13.8		1 732 500 013	0.007 5

15.4.2 Test data for Temperature(° C) _LTE Band 4

Temperature(°C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30			1 732 499 989	-0.006 3
-20			1 732 499 991	-0.005 2
-10			1 732 499 994	-0.003 5
0			1 732 499 999	-0.000 6
10	12	1 732 500 000	1 732 500 004	0.002 3
20			1 732 500 011	0.006 3
30			1 732 500 014	0.008 1
40			1 732 500 011	0.006 3
50			1 732 500 013	0.007 5

Tested by: Ju Yun Park / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



15.4.3 Test data for Voltage(V)_LTE Band 12

Temperature(°C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
20	12.0	707 500 000	707 500 008	0.011 3
	10.8		707 500 004	0.005 7
	13.2		707 499 998	-0.002 8

15.4.4 Test data for Temperature(° C) _LTE Band 12

Temperature(°C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30			707 500 011	0.015 5
-20			707 500 009	0.012 7
-10			707 500 002	0.002 8
0			707 499 998	-0.002 8
10	12	707 500 000	707 500 004	0.005 7
20			707 500 008	0.011 3
30			707 500 004	0.005 7
40			707 499 996	-0.005 7
50			707 499 998	-0.002 8

0

Tested by: Ju Yun Park / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



15.4.5 Test data for Voltage(V)_LTE Band 13

Temperature(°C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
	12.0		781 999 991	-0.011 5
20	10.2	782 000 000	781 999 989	-0.014 1
	13.8		781 999 994	-0.007 7

15.4.6 Test data for Temperature(° C) _LTE Band 13

P	1 , ,	—		
Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30			781 999 987	-0.016 6
-20			781 999 982	-0.023 0
-10			781 999 987	-0.016 6
0			781 999 993	-0.009 0
10	12	782 000 000	781 999 994	-0.007 7
20			781 999 991	-0.011 5
30			782 000 002	0.002 6
40			782 000 004	0.005 1
50			782 000 006	0.007 7

Tested by: Ju Yun Park / Assistant Manager