Anritsu envision : ensure

TETRA
Tx Test Solution

Signal Analyzer MS2830A

Reference Specifications

ETSI EN 300 394-1 V3.3.1(2015-04) / Part1: Radio

ETSI TS 100 392-2 V3.6.1(2013-05) / Part2: Air Interface

May. 2016

[Anritsu] TETRA Tx Test Solution

Tx Evaluation

Multi-functions supported with one unit!

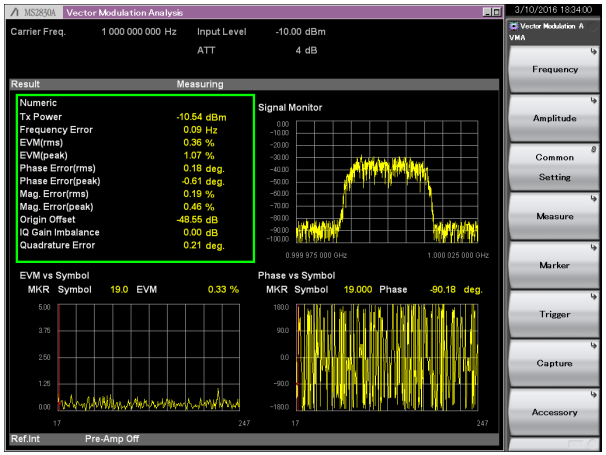
Unit, Module*

*Output in Test Mode

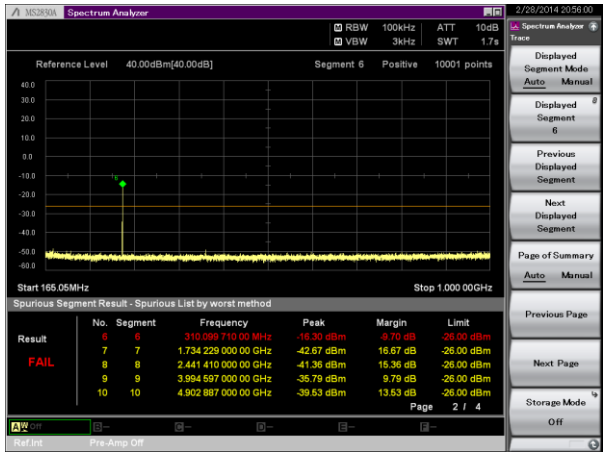
MS2830A
Signal Analyzer

- Spectrum Analyzer
- Signal Analyzer
- Modulation Analyzer (MX269017A)
- Signal Generator

MX269017A
Vector Modulation Analysis Software



Spectrum Analyzer
Spurious Emission Function



Class 7 is Transmitter parameter definitions and limits.
Class 8 is Methods of measurement for transmitter parameter.

EN300 394-1 V3.3.1 (2015-04)	8. Methods of measurement for transmitter parameters	MS2830A
7.1.1 8.1	Transmitter output power	---
8.1.1	Transmitter output power for phase modulation	
8.1.1.1	MS Transmitter output power for phase modulation	✓(MX269017A)
8.1.1.2	BS Transmitter output power for phase modulation	✓(MX269017A)
7.1.2 8.2	Unwanted output power in non active transmit state	✓(Signal Analyzer)
7.1.3 8.3	Adjacent channel power due to modulation	✓(Spectrum Analyzer)
7.1.4 8.4	Adjacent channel power due to switching transients	✓(Spectrum Analyzer)
7.1.5 8.5	Unwanted emissions far from the carrier	✓(Spectrum Analyzer)
7.1.8 8.8	Transmitter intermodulation attenuation	---
8.8.1	MS Transmitter intermodulation attenuation	✓(Spectrum Analyzer, Signal Generator)
8.8.2	BS Transmitter intermodulation attenuation	✓(Spectrum Analyzer, Signal Generator)
8.8.3	Intra BS transmitter intermodulation attenuation	✓(Spectrum Analyzer)

Vector Modulation Analysis [MX269017A] supports only TETRA Release 1 (π/4 DQPSK).

Class 7 is Transmitter parameter definitions and limits.
Class 10 is Methods of measurement for transmitter parameter.

EN300 394-1 V3.3.1 (2015-04)		10. Methods of measurement for transmitter/receiver parameters	MS2830A
7.3.1 10.1		Modulation accuracy	---
	10.1.1	MS modulation accuracy for phase modulation	✓(MX269017A)
	10.1.2	BS modulation accuracy for phase modulation	✓(MX269017A)
	10.1.3	Vector error magnitude at symbol time for phase modulation	✓(MX269017A)
7.3.2 10.2		Carrier frequency accuracy	---
	10.2.1	MS carrier frequency accuracy for phase modulation	✓(MX269017A)
	10.2.2	BS carrier frequency accuracy for phase modulation	✓(MX269017A)

Vector Modulation Analysis [MX269017A] supports only TETRA Release 1 (π/4 DQPSK).

8.1 Transmitter output power

8.1.1.1 MS transmitter output power for phase modulation

8.1.1.2 BS transmitter output power for phase modulation

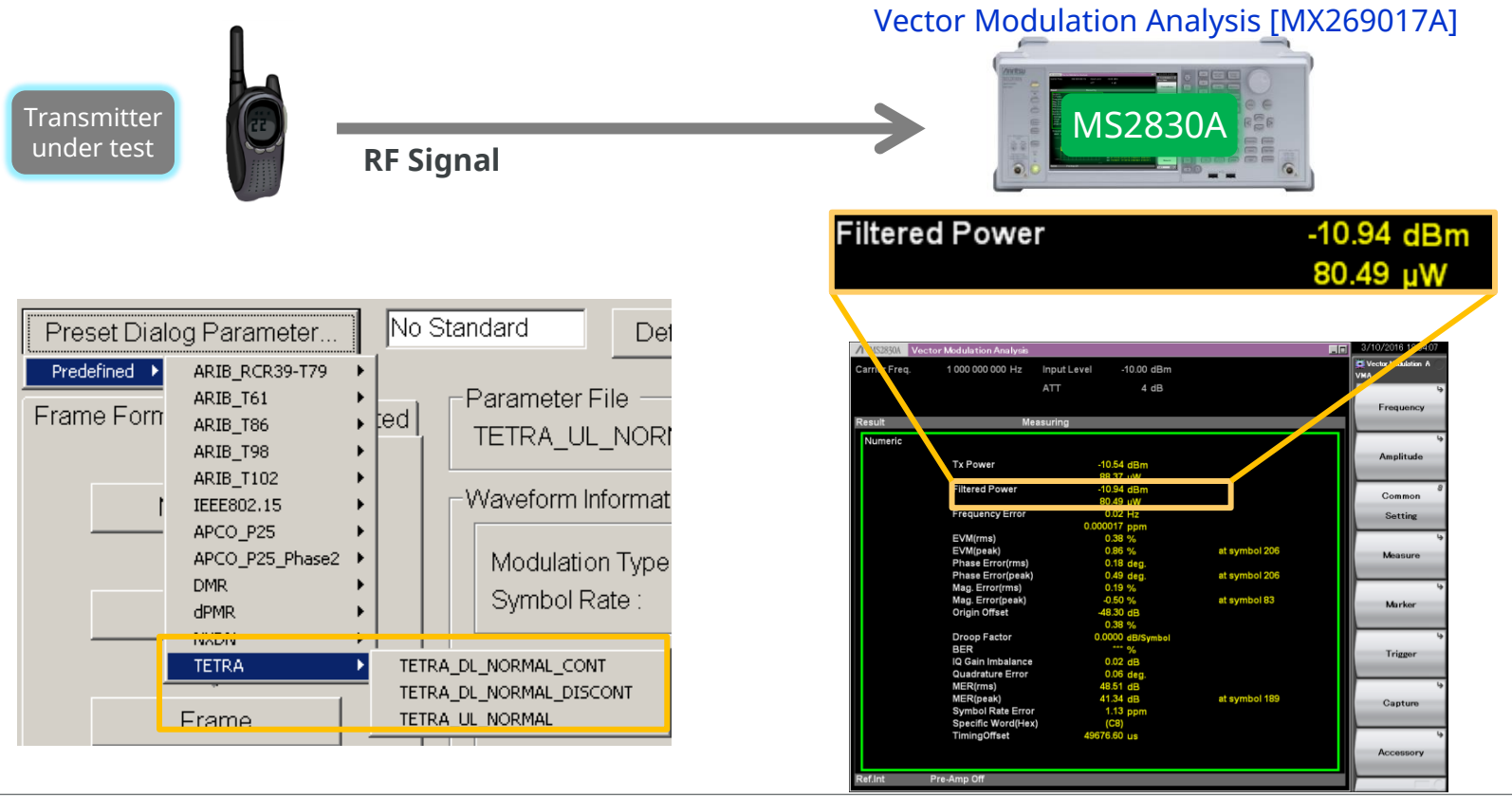
Output power for phase modulation

Limits:

within ±2.0 dB of the nominal value (normal test condition).

within +3.0 dB and -4.0 dB of the nominal value (extreme test conditions).

within ±2.5 dB of the MS power control levels. (The difference in level between adjacent power control levels shall be 5.0 dB ± 2.5 dB.)



8.1 Transmitter output power

8.1.1.1 MS transmitter output power for phase modulation

8.1.1.2 BS transmitter output power for phase modulation

RF Output power time mask (1/2)

Limits:

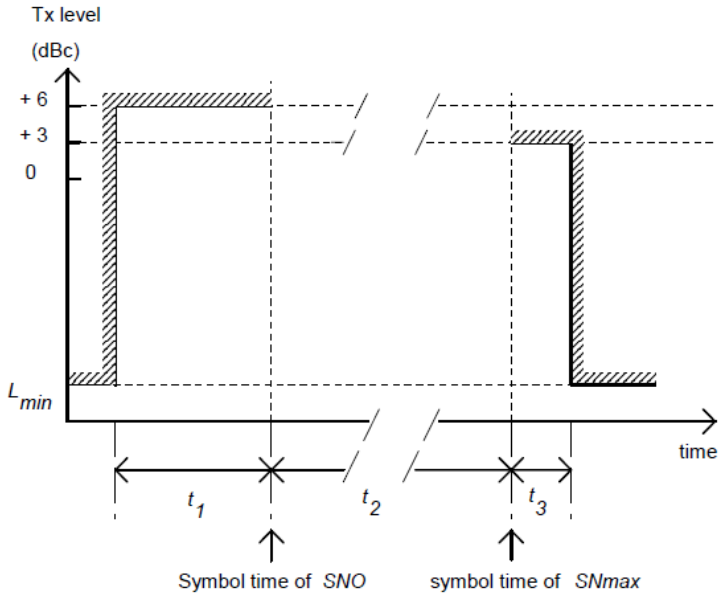


Figure 6.3: Transmit level versus time mask

Table 6.8: Transmit level versus time mask symbol durations (refer figure 6.3)

Burst Type	t_1	t_2	t_3
Control uplink	16	103	15
Linearization uplink	119	0	15
Linearization downlink	107	0	0
Normal uplink	16	231 (see note)	15
Discontinuous downlink	7	246 (see note)	7
Continuous downlink	Unspecified	Unspecified	Unspecified
NOTE: In the case of single slot transmission.			

L_{min} = -70 dBc or L_{min} = -36 dBm.

8.1 Transmitter output power

8.1.1.1 MS transmitter output power for phase modulation

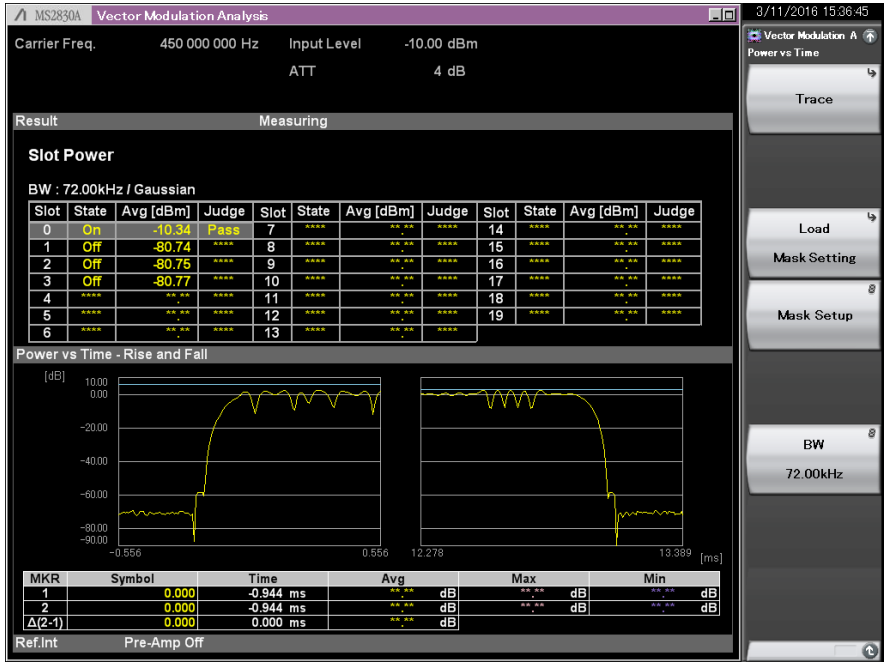
8.1.1.2 BS transmitter output power for phase modulation

RF Output power time mask (2/2)

Vector Modulation Analysis [MX269017A]

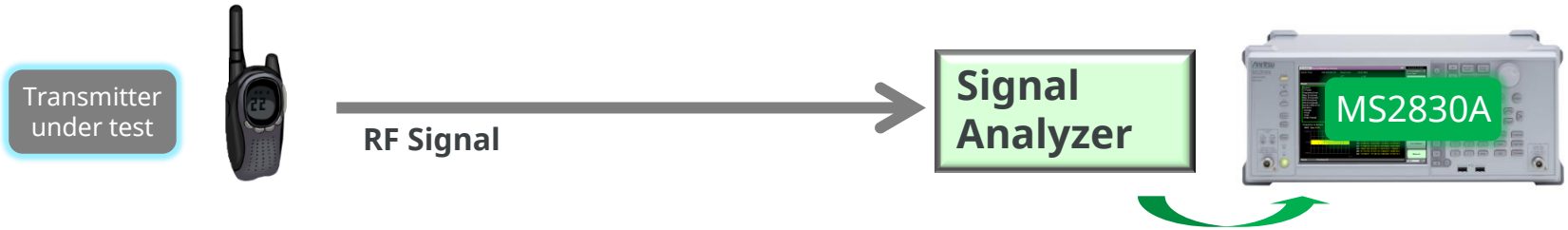
Transmitter under test

RF Signal

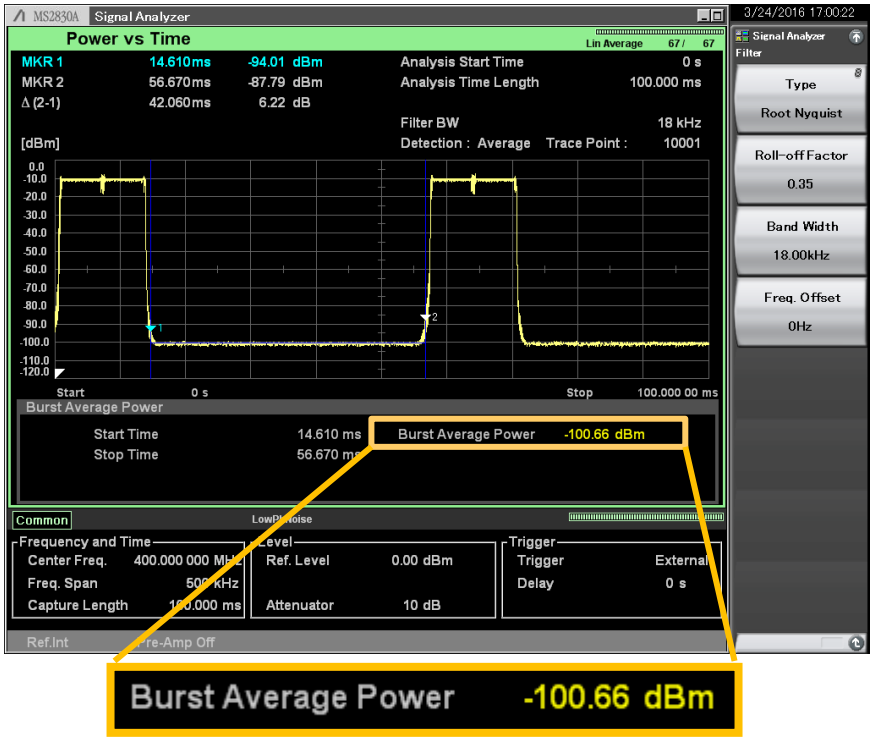


8.2 Unwanted output power in non active transmit state

Limits: -40 dBc (BS), -70 dBc (MS)

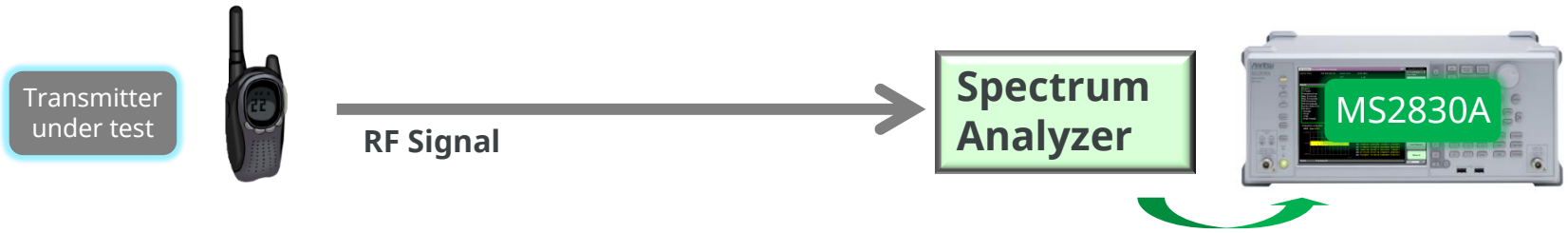


The unwanted output power in non-active transmit state is the average power emitted by a BS operating in discontinuous mode or MS transmitter, as measured through the TETRA filter.

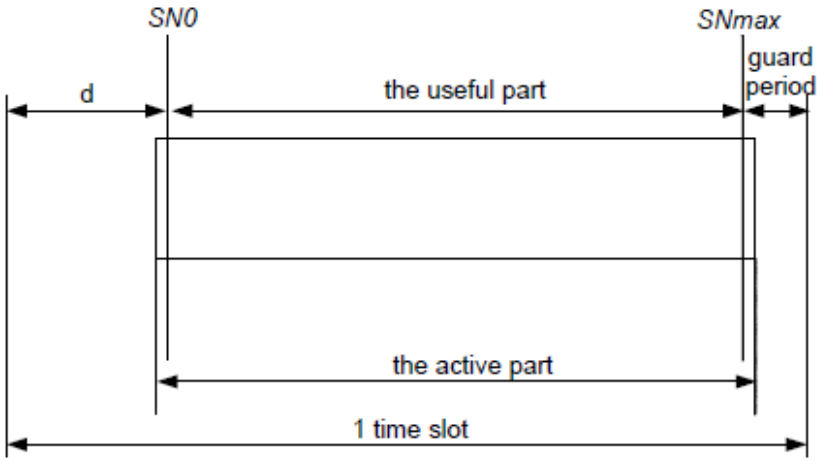


Unwanted output power in non active transmit state

8.3 Adjacent channel power due to modulation



The power measurements described here shall be timed to occur only during the useful part of the TETRA signal.



NOTE 1: For certain burst types d and the guard period may be of length zero.
NOTE 2: The active part of the burst is the period during which modulation symbols are present; it is longer than the useful part by an amount equal to the sum of the time necessary for symbol rise and decay.

8.3 Adjacent channel power due to modulation

Limits: below tables.

Table 7.1: Maximum adjacent channel power levels for MS power classes 4 and 4L

Frequency offset	Maximum level (normal test conditions)	Maximum level (extreme test conditions)
25 kHz	-55 dBc	-45 dBc
50 kHz	-70 dBc	-60 dBc
75 kHz	-70 dBc	-60 dBc

Table 7.2: Maximum adjacent channel power levels for other power classes

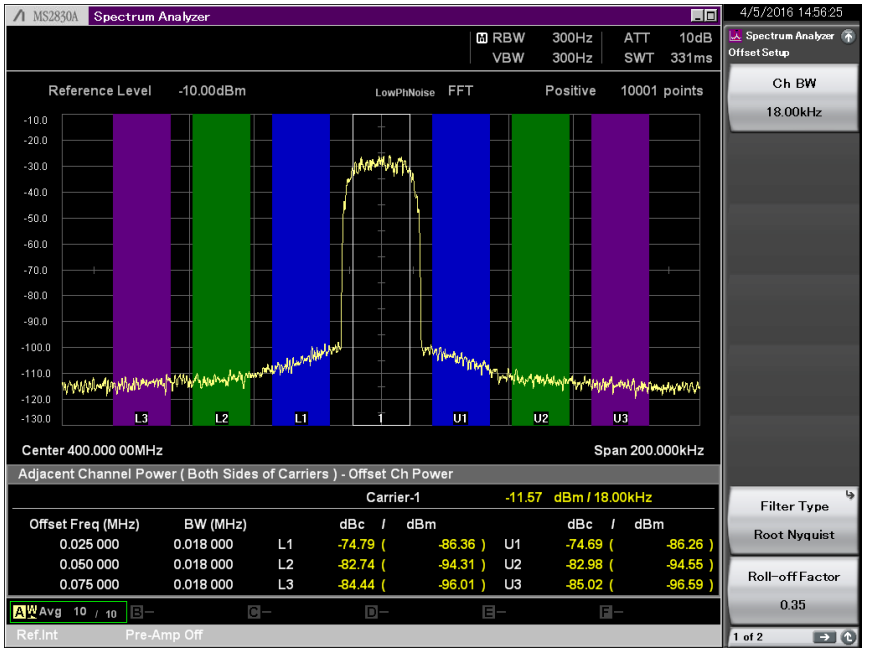
Frequency offset	Maximum level (normal test conditions)	Maximum level (extreme test conditions)
25 kHz	-60 dBc	-50 dBc
50 kHz	-70 dBc	-60 dBc
75 kHz	-70 dBc	-60 dBc

Table 7.3: Maximum adjacent channel power levels for frequencies above 700 MHz

Frequency offset	Maximum level (normal test conditions)	Maximum level (extreme test conditions)
25 kHz	-55 dBc	-45 dBc
50 kHz	-65 dBc	-55 dBc
75 kHz	-65 dBc (note 1)	-55 dBc (note 2)

NOTE 1: A level of -70 dBc shall apply for BS Power Classes 1, 2 and 3 and for MS Power Classes 1 and 1L.

NOTE 2: A level of -60 dBc shall apply for BS Power Classes 1, 2 and 3 and for MS Power Classes 1 and 1L.



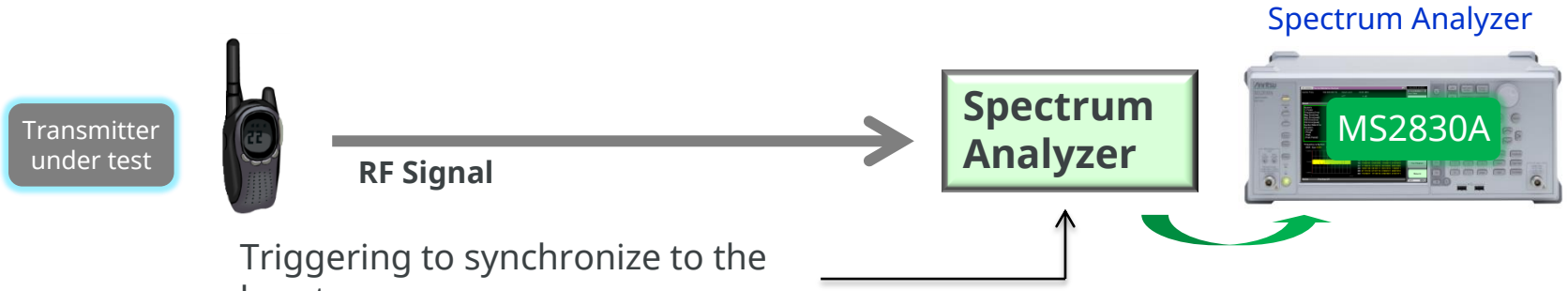
Option MS2830A-066 greatly improves phase noise, especially at carrier offsets of 1 kHz to 100 kHz.

Freq. Offset	MS2830A-066 Measured data
25 kHz	-74 dBc
50 kHz	-82 dBc
75 kHz	-84 dBc

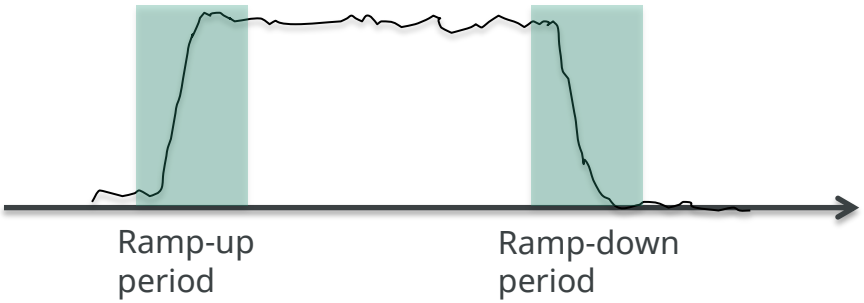
8.4 Adjacent channel power due to switching transients

Limits:

At a frequency offset of 25 kHz, shall not exceed -45 dBc for MS Power Classes 4 and 4L and -50 dBc for other Power Classes.



The peak power over the ramp-up and ramp-down periods of a burst, as measured through the TETRA filter. Appropriate triggering shall be used to capture the adjacent channel .



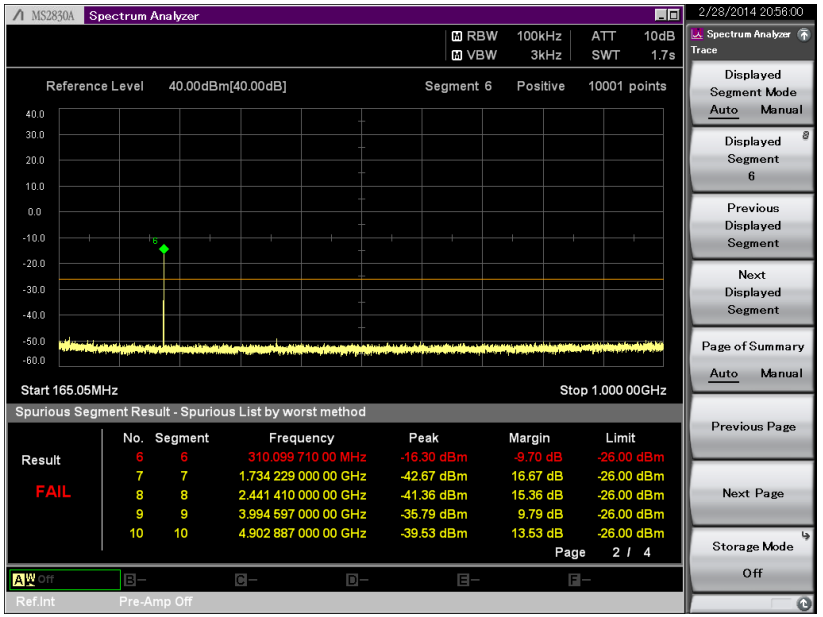
Gate Sweep Function [pre-installed]

Ramp-down period Measurement Example

8.5 Unwanted emissions far from the carrier

The filter may be used to eliminate carrier signal.

Spurious Function [pre-installed]



The below measurement bandwidth is used to measure discrete spurious.

Table 8.4: Measurement bandwidths

Measurement frequency	Resolution bandwidth	Video bandwidth (note 1)
9 kHz to 150 kHz	1 kHz	3 kHz
150 kHz to 30 MHz	10 kHz	30 kHz
30 MHz to 1 GHz (note 2)	100 kHz	300 kHz
1 GHz to 4 GHz	1 MHz	3 MHz
4 GHz to 12,75 GHz (note 3)	1 MHz	3 MHz
NOTE 1: When using a conventional swept frequency spectrum analyser. NOTE 2: Excluding frequencies within f_{rb} of the carrier. NOTE 3: Only for equipment capable of operating at frequencies greater than 470 MHz.		

8.5 Unwanted emissions far from the carrier

Discrete Spurious

Limits: -36 dBm/100 kHz (Frequency Range : 9 kHz to 1 GHz)
-30 dBm/1 MHz (Frequency Range : 1 GHz to 4 GHz
or 1 GHz to 12.75 GHz (operating frequency is above 470 MHz))

Wideband noise

Limits: below tables.

Table 7.9: Wideband noise limits for frequencies above 700 MHz

Frequency offset	Maximum wideband noise level		
	MS Nominal power level ≤ PL 4 (1 W)	MS Nominal power levels from 1,8 W to 10 W and BS Nominal power levels ≤ 10 W	MS and BS Nominal power levels from 15 W to 40 W
100 kHz to 250 kHz	-74 dBc	-74 dBc	-80 dBc
250 kHz to 500 kHz	-80 dBc	-80 dBc	-85 dBc
500 kHz to f_{rb}	-80 dBc	-85 dBc	-90 dBc
> f_{rb}	-100 dBc	-100 dBc	-100 dBc
NOTE: f_{rb} denotes the frequency offset corresponding to the near edge of the received band or 10 MHz whichever is greater. All levels are expressed in dBc relative to the actual transmitted power level, and in any case no limit tighter than -55 dBm for offsets ≤ f_{rb} or -70 dBm for offsets > f_{rb} shall apply.			

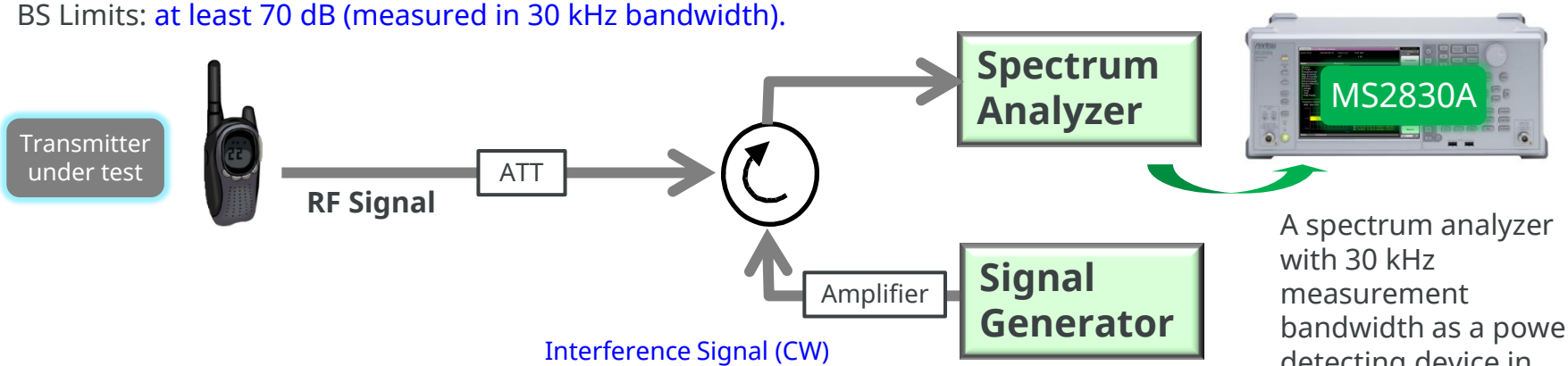
Table 7.8: Wideband noise limits for frequencies below 700 MHz

Frequency offset	Maximum wideband noise level		
	MS Nominal power level ≤ PL 4 (1 W)	MS Nominal power level = PL 3 (3 W) or PL 3L (1,8 W)	MS Nominal power level ≥ PL 2L (5,6 W) BS (all classes)
100 kHz to 250 kHz	-75 dBc	-78 dBc	-80 dBc
250 kHz to 500 kHz	-80 dBc	-83 dBc	-85 dBc
500 kHz to f_{rb}	-80 dBc	-85 dBc	-90 dBc
> f_{rb}	-100 dBc	-100 dBc	-100 dBc
NOTE: f_{rb} denotes the frequency offset corresponding to the near edge of the received band or 5 MHz (10 MHz for frequencies above 520 MHz) whichever is greater. All levels are expressed in dBc relative to the actual transmitted power level, and in any case no limit tighter than -55 dBm for offsets ≤ f_{rb} or -70 dBm for offsets > f_{rb} shall apply.			

8.8 Transmitter intermodulation attenuation

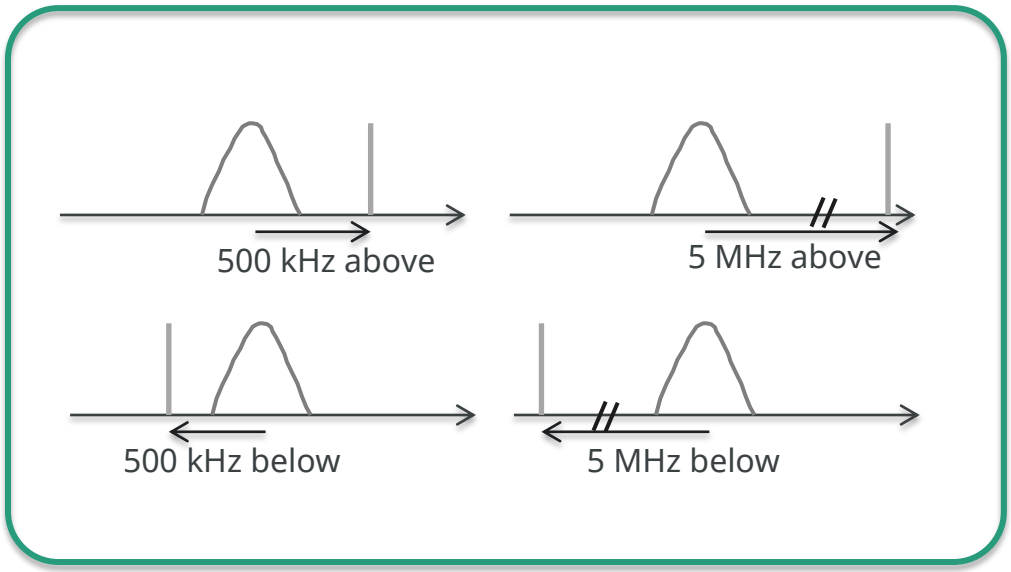
8.8.1 MS Transmitter intermodulation attenuation
8.8.2 BS Transmitter intermodulation attenuation

MS Limits: at least 60 dB (measured in 30 kHz bandwidth).
BS Limits: at least 70 dB (measured in 30 kHz bandwidth).



A spectrum analyzer with 30 kHz measurement bandwidth as a power detecting device in frequency domain.

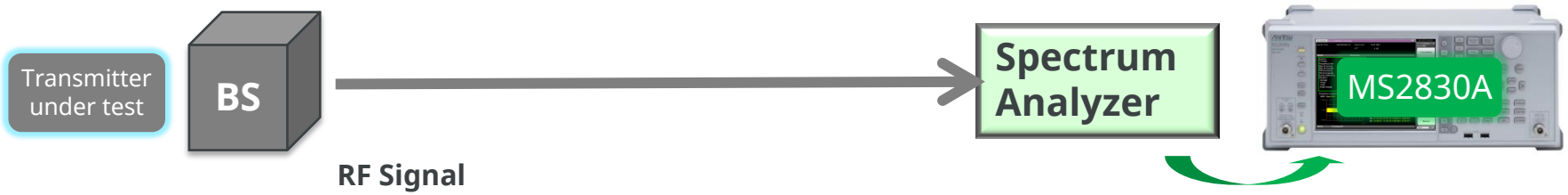
Frequency :
500 kHz above, 5 MHz above
500 kHz below, 5 MHz below
the frequency of the transmitter under test/



8.8 Transmitter intermodulation attenuation

8.8.3 Intra BS transmitter intermodulation attenuation

Limits: For all transmitters of a single TETRA BS, not exceed -60 dBc (measured in 30 kHz bandwidth).



RF Signal

In a BS, intermodulation may be caused by combining several transmitters and carriers to feed a single antenna.

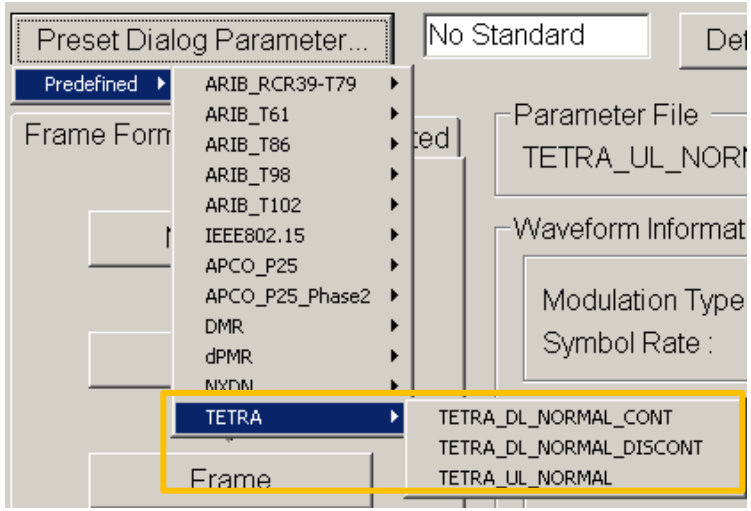
A spectrum analyzer with 30 kHz measurement bandwidth as a power detecting device in frequency domain.

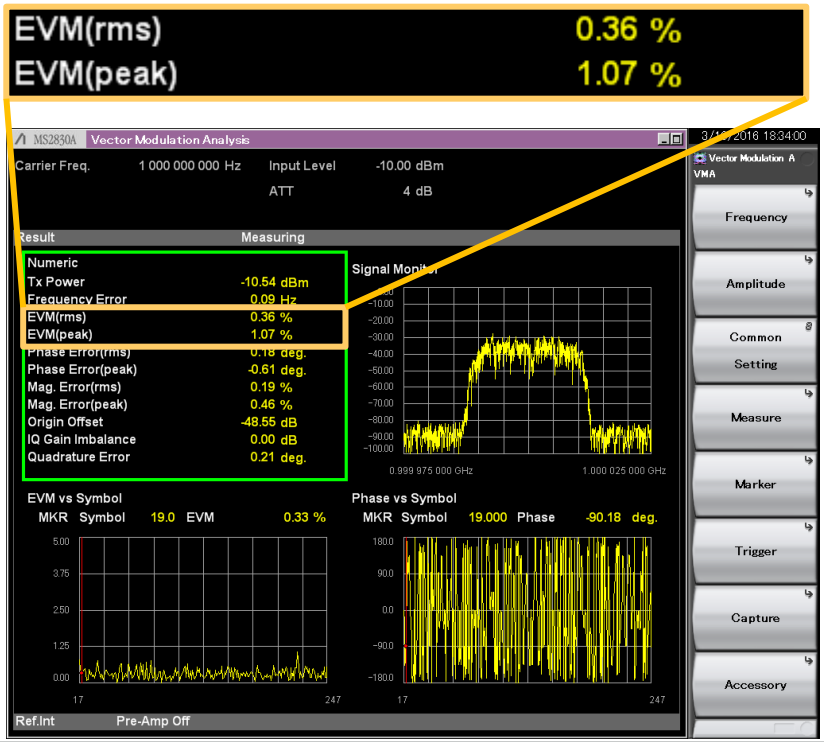
10.1 Modulation accuracy

10.1.1 MS modulation accuracy for phase modulation
10.1.2 BS modulation accuracy for phase modulation

Limits: less than 10% (RMS), 30% (Peak)

Vector Modulation Analysis [MX269017A]



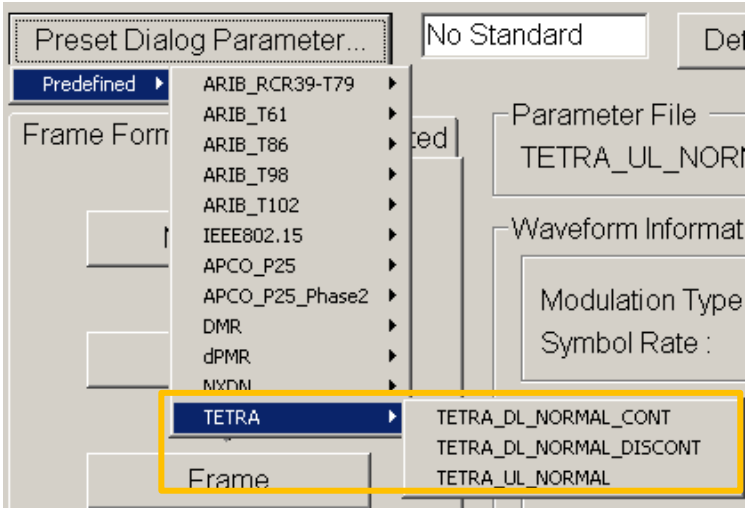


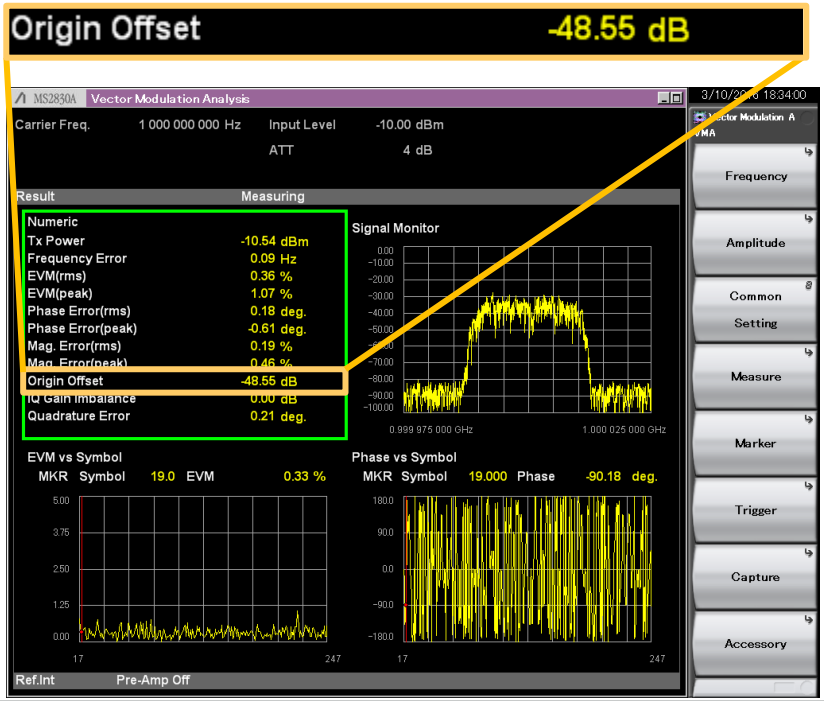
10.1 Modulation accuracy

10.1.3 Vector error magnitude at symbol time for phase modulation

Limits: Residual carrier magnitude shall be less than 5 % (-26 dB) in any burst.

Vector Modulation Analysis [MX269017A]



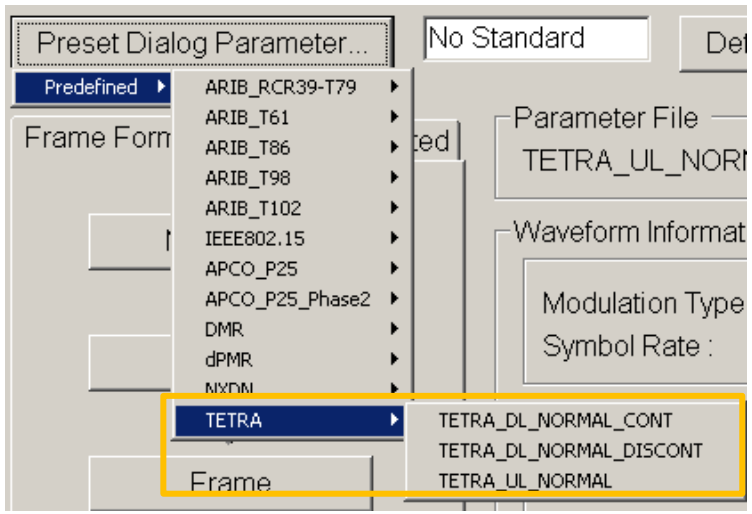


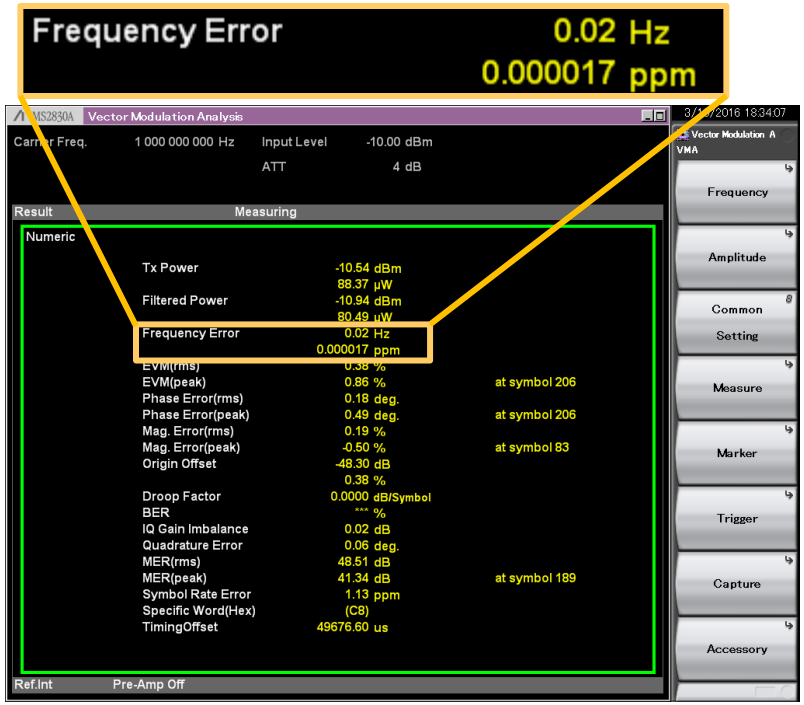
10.2 Carrier frequency accuracy

10.2.1 MS carrier frequency accuracy for phase modulation
10.2.2 BS carrier frequency accuracy for phase modulation

MS Limits: within ±100 Hz.
BS Limits: ±0.2ppm (up to 520 MHz), ±0.1ppm (above 520 MHz)

Vector Modulation Analysis [MX269017A]





Anritsu

envision : ensure

公知 2016-5 MG No. MS2830A-E-L-33-(1.00)